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New Key and Sounder.

The cuts illustrate a key and sounder now being introduced by the Western Electric Company, and meeting with general approval from telegraph operators.

The key, which is known as the "Steiner," is pronounced by experts the best adapted for fast sending of any manufactured. Its neat, compact appearance make it also very attractive. The same principle of a key lever is embodied in a legless key which will soon be ready.

The sounder gives a full, clear, sharp sound, produced by the set screw in the lever striking upon the top of a solid column on the resonating base.

Some Experiments on Secondary Cells.

BY JAMES SWINBURNE.

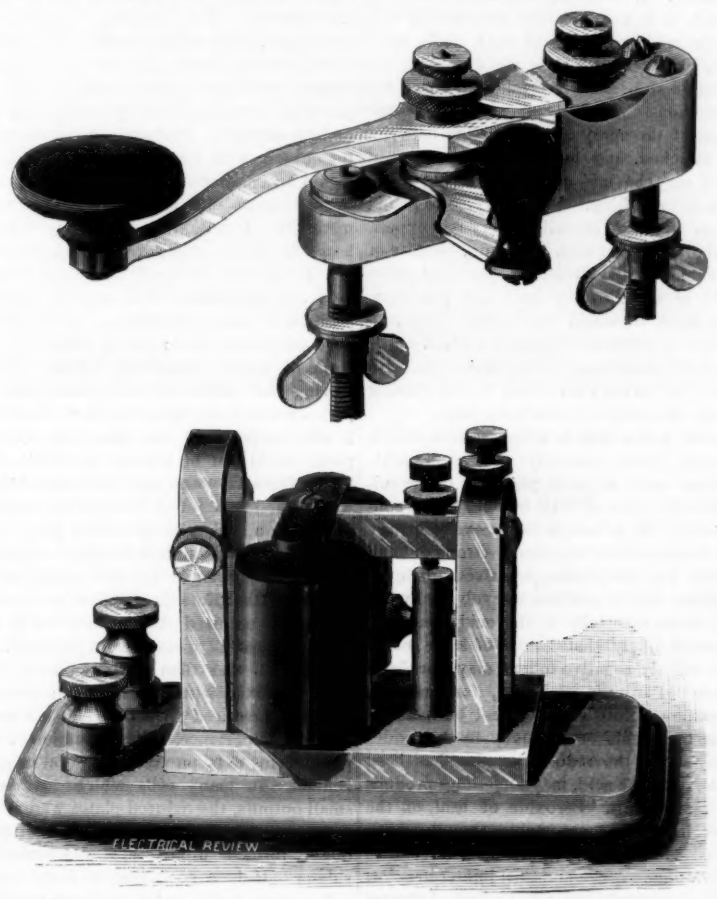
About four years ago Mr. Norman Cookson, of the well-known firm of lead manufacturers in Newcastle, brought out a process for making lead in the form of fine fiber or hair. Mr. Cookson's method is this: The lead is melted in a pot which is raised some feet from the ground; from the melting-pot is a tube which leads down some six feet, and ends in a rose like that used on a garden watering-can. The fall tube is kept hot throughout its length, so that when the lead is melted in the pot it is not solidified in the pipe. The melted lead then flows through the fine holes in little jets, and these jets solidify in the air, and fall in a tangled mass like lead moss. Some care has to be taken to keep the lead in the pot and in the tube at the right temperature, but this is the only difficulty, and the whole cost of the lead hair is not more than two shillings per ton above that of pig lead.

Those who were working at secondary batteries this time four years ago will remember that most people had the idea that the great thing to be aimed at was a very large surface. Mr. Cookson's invention, therefore, seemed most valuable, and he set to work with the energy which is his characteristic, especially when working at something new. Mr. Cookson made up a dozen large cells, which he sent to Mr. Jameson, the inventor of the coke process, who was then working at an incandescent lamp. Some of the lead hair was made up into little cells, and tried in various ways by Professor Herschel, of Newcastle. Professor Herschel published some account of his work in *Nature*. Mr. Cookson also made arrangements with the writer to go into the question of secondary batteries. The theory that large surface of lead was necessary gave way when the question of local action was more fully studied, but after all it seems to be near the truth.

Some reason may be demanded for bringing before this society the account of experiments which were made so long ago. Many of them have been made again since, and many are of no use at all; but, on the other hand, there are a number which are still new, and the next best thing to knowing what to do is knowing what not to do. We made altogether more than three hundred different cells; but, to prevent this paper running to too great a length, only a few of them are described.

CELLS WITH HAIR LEAD.

The first were Mr. Cookson's large cells These had four plates; each plate was about 8 inches by 10 inches by 1 inch, and consisted of a sort of cage of sheet lead with holes in each side. The lead was joined by burning, no solder being used. The inside of the cage was filled with lead hair, a lead wire being arranged zigzag through it, and burnt to the cage. Each plate was sewn in flannel. A battery of twelve of these cells was sent to Mr. Jameson to be charged. They came back to the lead works without any particulars as to what had been done with them. We therefore coupled them up with a dynamo, and charged them in what appeared to be the opposite direction. They had 12 amperes through them for about



STEINER KEY AND SOUNDER OF THE WESTERN ELECTRIC COMPANY.

seven hours a day for no less than five months, and even after three months gas was coming off the reduced plate only. The cells seem to have had enormous capacity, and must originally have been charged in the other direction. After three months the reduced plate gave off gas, but the peroxide plates went on charging for the whole five months. We did not try running them down to see what charge they really had, as other experiments which were going on at the same time led us to suppose that the local action would render them useless. Probably the surface of these plates was so large that the local action formed enough sulphate of lead during the night to utilize the current during the whole of the next day in oxidizing it. At the end of the five months the flannel round the plates was not spoilt. This seems to show that it is not the acid that spoils the flannel in the Faure cells, but the oxidation due to the contact of peroxide of lead. Some experiments on organic substances with oxidizing agents will be described presently.

The first difficulty to be overcome with the Cookson lead hair was making good electrical connection with the support. Various methods of soldering were tried, but the little wires of lead were melted off whenever it was tried to burn them to the back. Solder with a flux of caustic soda ran along the fibers too much. Various methods of connecting the fibers by pressure were tried. The material was woven into loose mats, and these were passed under large rollers. Every degree of density could be obtained in this way. Though the metal was clean, and appeared to stick together at first, it did not adhere as strongly as might have been expected. The chief fault of the lead hair seemed to be the vice of local action. In those days local action was not so well understood as now. The theory seems to be this: If lead and peroxide of lead are electrically connected, and any of the surface of the lead is exposed to the acid, that part of the surface is attacked, and a thin film of lead sulphate is formed, which protects the surface from further corrosion. The lead is then in contact with the peroxide at some points, and with lead sulphate at other points, but is not touched by the acid anywhere. If the cell is charged further, the film of lead sulphate is oxidized into peroxide, so that the plate again consists of lead and peroxide of lead only. As the peroxide formed from a given quantity of lead sulphate occupies much less room, a small portion of the surface of the plate is again exposed, but is immediately coated with a film of peroxide; the result is that the whole surface of the plate is protected. The least movement seems to expose some of the surface of the lead to the acid. The lead can thus be protected by anything that prevents its contact with the acid. For local action to take place, some of the lead must be exposed to the acid. If, while a cell is charging, a clean surface be made on the peroxide plate, it will immediately be covered with a thin film of peroxide, which will protect the plate from further attacks. If, on the other hand, the dynamo is disconnected and a clean surface then exposed, it will be immediately covered with a film of sulphate, which will protect the plate. Thus the plate may be protected either by sulphate or peroxide. When the lead of a plate is converted into peroxide, the plate is being charged. When the lead is converted into sulphate, local action is going on. In the large Cookson cells the fibers of lead were converted into peroxide during the day by charging, and more lead was converted into sulphate during the night by local action; so that it was unnecessary to reverse the batteries to secure more rapid formation, the formation being already rapid enough. Mr. Crompton told me this summer that he found that cells were practically indestructible if not discharged too much, and this seems to be the grand secret of successful work with secondary batteries. Messrs. Drake and Gorham mentioned the same thing in their paper read at the British Association this autumn. Either the peroxide of lead is so porous that it never quite protects the plate, or it is disturbed by small bubbles formed in the coating; for if a current is passed continually in one direction a lead plate is eaten into, as may be seen in a water resistance with lead electrodes—the oxidized plate seemingly does go on forming. In the lead hair cells the surface exposed was so enormous that a very slight formation was enough to demand a very large supply of electrical energy, so that the cells seemed to run down as fast as they were charged. No doubt the fault was that the fibers of lead used were rather too fine; if we had used much thicker lead wire we should have probably made a very good battery. Several plates were tried with hair lead, red lead, litharge, etc., but our ideas as to the validity of Faure's patent were not quite what they are now, so comparatively little was done in that direction.

Secondary cells are, however, tedious things to experiment upon; it may take a year or so to see what a cell is going to do. The best method is to keep several sets of experiments going on at the same time.

For the sake of conciseness some of each class will be given, arranged in groups.

QUICK-FORMING.

Cells were made with lead hair in a solution of sodium chloride: the anode was quickly

attacked, but the coating was not adherent, and came off in clouds; black clouds, presumably of finely-divided lead, came off the other plate.

Lead hair and potassium bichromate: seem to oxidize well.

Lead hair and possium sulphate: no very marked result.

Amalgamated lead in dilute sulphuric acid: the peroxide formed had little stiction or power of adherence, and kept peeling off and exposing the bright amalgamated surface; this happened especially on reducing.

The object aimed at was to get an electrolyte which partly dissolved the plate; the idea being that an action like that of which advantage is taken in the manufacture of white lead might be used in the quick formation of battery plates.

Lead in solution of sodium-thiosulphate: thick black mud of lead sulphide formed.

Amalgams of lead and 10 per cent. and 5 per cent. of mercury: coating had no stiction.

Alloy of lead and zinc: this was not so easily attacked as one might expect.

Lead hair in solution sodium hydrate and sulphide: the solution got yellow, and deposited sulphur on the oxidized plate.

Lead in solution of ammonium chloride: was no better than the similar cell with sodium chloride. No doubt a little nitric acid was formed, but the cell was not a success.

Cells were tried with solutions of potassium fluoride: the plates were not formed well.

Lead in potassium sulphides: not much attacked; the action of the sulphide seemed uncertain, and is partly dependent on the amount of hydrate present.

Lead plates in solution of salt, with felt between: after reversal this gave good spongy lead, but a great deal of the peroxide was loose and detached.

Lead with various mixtures of sulphides and carbonates and nitrates: none of these gave deposits which would reduce well—they were all too loose.

Lead in sulphuric acid: just diluted enough to make it conduct; the anode was not much attacked.

Lead in a mixture of sulphuric and nitric acids: more quickly formed.

Lead in nitric acid alone: eaten through very quickly. The action of nitric acid on a lead plate is very peculiar. Most of the solutions already mentioned attacked the plate evenly and oxidized it gradually through, but nitric acid makes pits and round holes. As nitric acid seemed by far the best means of quick formation, several experiments were made with it. Plates were eaten wholly through with acid which was too strong to dissolve much nitrate; the acid was then siphoned off and replaced by a solution of sodium sulphate and reversed. There was difficulty in reducing the lead sulphate; it formed cakes which did not make good contact with the plate. The great objection to the various methods of forming above described is that the coatings produced have too little stiction to reduce well. When lead was the anode in nitric acid no peroxide was produced. Of course no peroxide is formed when the plate is in contact with sulphuric and hydrochloric acids, as peroxide of lead liberates chlorine in an acid solution, while chlorine precipitates lead peroxide from an alkaline solution of the lead salt.

The best solution we tried for forming plates was a mixture of dilute sulphuric and acetic acids; this solution made a fine and adherent coating which reduced well. One of the most obvious disadvantages of such solutions as dilute nitric acid is the difficulty of getting rid of the least traces of acid; of course, traces of such things as nitric or hydrochloric acid in a cell may be very destructive, or they may be quite harmless. Acetic acid can easily be driven off as vapor, and nitric acid might perhaps be reduced to ammonia and then volatilized.

Mr. Brush heats his plates to accelerate their formation; we did not try this.

LOCAL ACTION.

To reduce the local action in the peroxide element we tried amalgamating the plates; this did not act. We tried to gild lead plates, but did not succeed; a gold sleeve-link seemed to act well as a support for a little peroxide plate, and it was hoped that gilding might preserve lead. We tried to protect lead by various sulphides. These experiments seem absurd; in fact, many of our experiments were rather wild; but the supposed method of protecting plates has recently been patented by no less able a chemist than the late Mr. Tribe. Lead was fused with various proportions of galena, and the resulting substances were tried as anodes. Galena itself is at once coated with lead sulphate when used as anode in dilute sulphuric acid.

Lead was also combined with arsenic by heating in glass tubes; this was very troublesome work, as the arsenic was apt to volatilize, and sometimes the tubes broke, and the laboratory had to be abandoned until the smell was gone.

Double sulphides of antimony and sulphur bases were tried, but were of no use. In our provisional protection, applied for in 1883, we mention coating the plates with lead sulphide by means of thiocarbamide. This idea was taken from a receipt seen in a copy of the *Plumbers' Times and Paperhangers' Gazette*, or some such paper, which was sent me with an intimation that I had no business not to take in my trade journal. Thiocarbamide could not be bought, and was too troublesome to make, so this was not tried. The process is said to produce a beautiful polished adherent coating of lead sulphide on lead, or even on organic substances, such as netting, and is of very considerable interest, and perhaps of commercial value.

Silver was tried as peroxide plate in various solutions. It behaved very much like lead, though it is not so easily attacked by sulphuric acid; peroxide of lead sticks to it well, but of course it is too expensive for commercial use. Silver might be used for connections. Most metals exposed to the action of the spray from secondary batteries are attacked, and make bad contacts, but silver may be laid across the top of a cell without tarnishing. Probably electro-plated copper would do as well. Very few experiments were tried with platinum, because of the expense. Mr. Brush has patented plates made of an alloy of lead and platinum. Most likely it would take a very large proportion of platinum to protect a plate, as the alloys of platinum are easily oxidizable. No doubt Mr. Brush's invention is only waiting for the discovery of a platinum mine.

Local action may be a very serious evil in reduced plates, especially with strong acid. In some cases reduced plates in dilute sulphuric acid give off little bubbles of gas continuously for a couple of weeks. Spongy lead seems to have very nearly strong enough affinity for the electro-negative radicle of sulphuric acid to combine by evolving hydrogen, more especially if the acid is strong. It seems likely that traces of some metal even slightly negative to lead may start local action. Platinum and lead, for instance, decompose dilute acid at once; but perhaps traces of arsenic or antimony in the oxides from which the reduced coating has been made, or in the acid, may sometimes produce the same result. Peroxide of lead, on the other hand, is more stable, though, when heated with strong sulphuric acid, it seems to evolve some oxygen and turn lighter in color.

Electro-gilded copper was attacked at once by sulphuric acid.

CARBON FOR PEROXIDE PLATES.

The practice of making peroxide plates of carbon does not seem to be quite abandoned even yet. Carbon is more easily oxidized than is popularly supposed; in fact, Brodie's process for disintegrating graphite depends on the action of an oxidizing agent. We tried some Faure plates with carbon in dilute sulphuric acid, and in a solution of zinc sulphate. In both cases the carbon was attacked. After standing for some days the peroxide plates seemed quite good, and the peroxide appeared to stick well to the carbon, and to form good coatings. On examination, however, it was found that the carbon under the peroxide was converted into a soft black pulp. Carbon was tried as anode in various solutions, such as sodium carbonate, sodium phosphate, phosphoric acid, dilute sulphuric acid, potassium fluoride, potassium sulphide, hydrochloric acid, liver of potassium, potassium chromate, ferri-cyanide, ferro-cyanide, permanganate, borax, potassium tungstate, potassium hydrate, sodium chloride, etc. In all cases where oxygen would otherwise have to be evolved the carbon was attacked; but when a current could pass by evolving chlorine, the carbon was not attacked. As peroxide of lead acts on a chloride in an acid solution, carbon is evidently useless for peroxide plates. It may do admirably for bleaching or evolving chlorine, or making hypochlorites. The same conclusions were arrived at by Bartoli. Biscuit, or unglazed porcelain, impregnated with carbon deposited from hydrocarbon by heat, was tried; it split into small pieces. It is odd that none of the sufferers from primary battery disease have used this material for porous pots, as many of them have the idea that a carbon porous pot somehow reduces the resistance of the cell.

As no metals were available as indestructible supports for the oxidized plate in dilute sulphuric acid, and as carbon also appeared useless, the next thing was to try to make the supports of peroxide itself. Peroxide made by oxidizing coatings, made originally from litharge or red lead, was not hard enough to make good supports; but the peroxide deposited by electrolysis of an alkaline solution of a lead salt was very much harder. The best way seemed to be to make a paste of litharge and caustic soda, and to attach it to the lead plate, and make it the anode in a solution of caustic soda. When the whole of the litharge was oxidized, the lead plate was removed. The resulting peroxide was very hard, and seemed quite impervious; when a bit was used as a plate in a cell, and the cell discharged, it ran down at once, the peroxide being covered by a very thin film of lead sulphate. The surface seemed to be the only part in contact with the acid. It would be a matter of great practical difficulty to make cells with peroxide supports commercially. It would be interesting to know how this form of peroxide compares with Mr. Fitzgerald's *lithanode* in point of hardness and durability. The peroxide from a solution of nitrate and tartrate of lead looks very dense and hard; but it comes in the form of scales resembling iodine. Before leaving the subject of lead plates, some experiments on lead sulphate must be described. It was supposed at one time that lead sulphate could not be reduced in dilute acid. Sir William Thomson had made experiments with it, and had found it would not reduce. We made a cell with platinum plates and precipitated lead sulphate in dilute sulphuric acid; it was charged for five weeks, and at the end of that time the sulphate on one was completely oxidized; but on the other it was only reduced here and there in spots. A similar cell was then started with a little litharge mixed with the sulphate; the sulphate then reduced perfectly. This is a result of some importance. The reduction of sulphate seems to be purely a question of good contact. In many cells which gave very small outputs, the reduced plates were found to be in fault. The slightest film of thoroughly-formed sulphate acts as a perfect insulator. It is a good plan to keep a small cell always ready, with both plates fully charged; then, when a cell under test runs down, each plate is separately tried with a proof plate, and it is then found which of the plates has failed. The film of sulphate formed on a piece of lead reduces all right; but as sulphate of lead is very bulky, its formation seems to cause buckling about and resulting bad contacts. To see how great the swelling due to the formation of sulphate of lead is, the specific gravities were taken, and the following are the resulting figures:

100 volumes of lead form—

Peroxide of lead	160
Red lead	148
Litharge	151
Lead sulphate	297

This shows that lead converted into sulphate swells into three times its original bulk, and that peroxide on becoming sulphate is doubled in volume; this at once shows why coatings tumble off plates. To see how much of the active material in a cell is really used, several plates were made up with weighed quantities of lead oxides. One of these was a little Sellon plate, made of a piece of a large plate filled with minium or litharge; others were Faure plates. After charging, the plates were short-circuited through copper voltameters. The maximum output was from 5 to 7 per cent. of that calculated.

Many attempts were made to make coatings that would stick well. Collodion was of no use; litharge and sugar did not make good coating; sodium silicate mixed with the litharge before applying was useless. Litharge and glycerine form a very useful cement known as engineers' cement. Though the coating was very easy to manage, there seemed to be no permanent advantage in using glycerine. This coating has been patented. In those days it was usual to wrap plates in flannel to keep the coating on. The flannel generally went to pieces very soon; it appeared, however, that this is not due to the action of the acid, but to oxidation through contact with the peroxide. Asbestos paper is too weak to be of any use. Cotton or linen is soon destroyed by acid, but resist strong alkali longer; while flannel resists acid, but is attacked by alkali. Pyroxylin is easily attacked by alkali, not easily by acid. Tribe proposed to use pyroxylin for supporting plates. Xylonite has also been tried for me more recently by Mr. Cathcart, then my assistant. It is much the same as celluloid, being made of pyroxylin and nitro-benzole, camphor, or some such solvent. This will stand being boiled in moderately strong sulphuric acid for a long time, and should be very useful in battery work. Flannel was soaked in collodion, with the idea that the fibers might thus be protected, but they were not. Flannel was also soaked in sodium silicate and attacked with sulphuric acid: it succumbed.

STRENGTH OF ACID.

It was usual to use acid of a strength of 1 to 10. This probably arises from that being the strength in vogue for Daniell batteries.

The strength of acid was also not considered, because the action of secondary batteries was, for some unaccountable reason, supposed to be due to the formation of litharge on both plates. I am afraid Dr. Lodge was much to blame for perpetuating this error. Another absurd theory was that the action is due to occluded hydrogen in the reduced plate. It has been said that the study of secondary batteries belongs to chemists, not to electricians; but it is strange that when chemists have to deal with electrolysis they seem to forget their chemistry, or to imagine that the laws of chemistry no longer hold good. As the action of the cell depends on the formation of lead sulphate, it is clearly an advantage to have as much acid as possible available in the coatings.

On looking into Gladstone and Tribe's book on secondary batteries they are found to state that the action on the peroxide plate is as follows: The peroxide is reduced to monoxide, and the sulphuric acid then combines with this to form lead sulphate and water. If this were the case the energy due to the combination of the lead with the sulphion would be entirely converted into heat, not into electrical energy. Chemists have a lot of time-honored ideas which do not at all fit the facts of electrolysis. One is that salts are formed by the combination of an acid and an alkali. In old days people spoke of the sulphate of the protoxide of lead and so forth, and lead sulphate was represented as PbO,SO_3 when it was understood that the water was eliminated. Even now chemists seem to assume, without foundation, that a metal cannot form a salt without passing through the intermediate state of oxide, through really an oxide is itself just as much a salt as a nitrate or sulphate. If electrolysis proves anything at all it is that a salt is made up of an electro-negative and an electro-positive radicle, not of a base and

an acid with some water eliminated. The action of an acid and an alkali is simply the exchange of radicles, the most electro-negative radicle combining with the most electro-positive, making a salt in which neither proponderates, or, as it is called, a neutral salt.

If the coatings have only weak acid it may be all absorbed when the cell is discharged a little, and the electromotive force will fall, and there will be a tendency to the formation of basic salts in the coatings; but, on the other hand, if the acid is made stronger, it may be decomposed without electrolysis, as when peroxide of lead evolves oxygen and forms lead sulphate, or as when spongy lead evolves hydrogen and forms lead sulphate. In the case of spongy lead there may or may not be electrolysis. If the acid is so strong that the lead decomposes it directly, there is no local action; but if there be some more electro-negative metal, such as, say, antimony, in contact with it to evolve the hydrogen, there is electrolysis.

Another universally accepted theory without any foundation is that all electrolysis is due to the action of nascent hydrogen or oxygen. In old times when someone saw bubbles coming off zinc in an acid solution of, say, an iron persalt, and found the persalt was reduced to a protosalt, he naturally supposed the gas was the cause of the action. But there is no reason to suppose the hydrogen has anything to do with it. It takes a certain electromotive force to give off the hydrogen, and a certain less electromotive force to reduce the persalt. If the available electromotive force is between these values, the persalt will be reduced without any hydrogen being formed. To suppose that hydrogen is first formed, and that the thing then changes its mind and does an easier chemical action, is unphilosophical. The combination of the zinc with the available negative radicle will go on, the action being made possible by the reduction of the persalt when present, and by evolution of gas when no persalt is present at that spot. The nascent gas idea is like saying that when one goes up to the first floor one goes to the roof and tumbles down again to the first floor.

Still further reduction takes place in thousands of ordinary chemical actions where no hydrogen is present, as when carbon monoxide is passed over hot litharge. Again, electrolysis takes place quite well without hydrogen or oxygen being present as when a fused metallic chloride is electrolyzed.

Another unfounded theory is that it is the water that does all the conducting, and that it is first decomposed, the other action being secondary. Pure water does not conduct, neither does pure sulphuric acid, but the mixture does; how, then, is it inferred that the water only of the mixture conducts? No doubt the only way to study electrolysis is to divest it of all preconceived theories that have no logical foundations, and to study thermo-chemistry.

The best strength of acid was not determined by us, and it no doubt depends on the purity of the lead, and of all the compounds forming the coatings, and of the acid itself. It also depends on the way the cells are to be used. If the acid is strong, both oxygen and hydrogen will be given off slowly, even during several weeks. As the idea of using secondary batteries as magazines for storing energy for long periods is being given up, this slow decomposition is of little importance; but there is another point—that is, that sulphuric acid which is not very dilute separates into two strata of different specific gravities. Before leaving the subject of lead cells, it may be as well to mention that the troublesome spray that comes during charging may be prevented by floating paraffine on the top of the acid. The spray not only tarnishes, rusts, or destroys everything near, but is the cause of all sorts of ground leaks. The paraffine prevents the acid from creeping; in fact, it creeps itself, and acts as an insulator.

ALKALINE CELLS.

It is well known that iron is very electro-negative in an alkaline solution; but such solutions as that of caustic soda or potash are not available, because nearly all salts of lead are soluble in them. It was therefore attempted to make cells with iron supports in an alkaline solution of some salt whose acid radicle would not attack iron, and would precipitate lead salts. Iron in solutions of potassium cyanide, ferro-cyanide, and ferri-cyanide was attacked; the ferro-cyanide or yellow prussiate of potash plate was least eaten. Even such salts as sodium sulphate dissolve some lead sulphate. This property is important in connection with ordinary secondary batteries. A little sodium sulphate mixed with the acid may tend to make the sulphate of lead more easily reduced; as, when all the sulphate is reduced that is in contact with the support, hydrogen is evolved, and caustic soda is formed in the immediate neighborhood of the plate, and can dissolve the sulphate, the lead being then precipitated as spongy lead. The spongy lead can thus make contact with the sulphate. Magnesium sulphate has been recommended as a solution, but it is difficult to see why. Zinc sulphate might be good.

Alkaline sulphides of course attack iron.

Iron plates with coatings of white lead in solutions of sodium carbonate; these oxidized and reduced very well, but the iron seemed to be slightly attacked. On testing the peroxide, traces of iron were found. Thinking the corrosion of the plate was perhaps due to impurities in the carbonate, such as sulphate, experiments were tried with the purified salts. The iron seemed to be in a sort of unstable state. Sometimes it would remain quite clear and bright in contact with the peroxide, and with bubbles of oxygen evolving from its surface; but suddenly a green spot would appear, due no doubt to the formation of carbonate of iron, and this spot would extend and cover the whole plate. The best results were got with bicarbonate of soda.

Nickel was tried in the same solution; it behaved in the same way, though it was not quite so easily attacked. The carbonate was lighter in color, being apple green.

Iron plates with borax solution: green discoloration.

Iron plate with caustic, potash, and tannin: iron eaten.

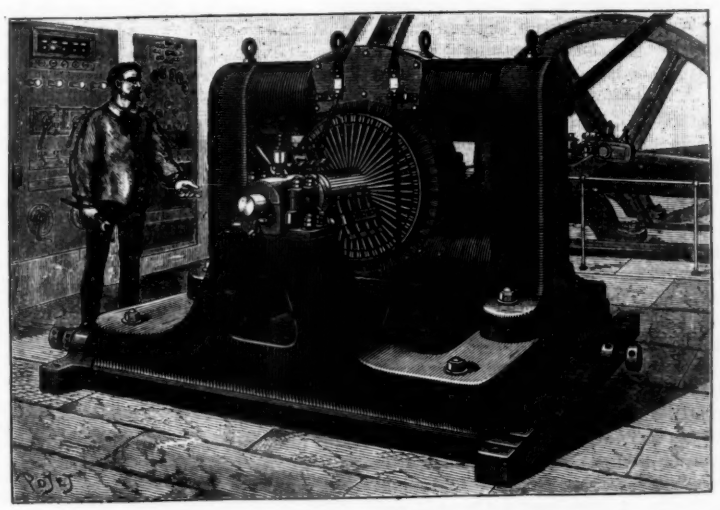
Some cells were tried with iron plates and ammonia; but as it is probable that nitric acid would soon be formed in them they were abandoned. The alkaline cells gave 1.7 volt. The measurements were taken roughly. A calibrated tangent galvanometer was used as a voltmeter; for measuring currents a low resistance was made up, consisting of a lot of wires put in parallel, their resistance having been measured in series.

Ammonia sometimes gave a brown deposit with iron plates.

As it seemed hopeless to get iron to stand without being attacked, various methods of protecting it were tried. Iron gauze was coated with peroxide by making it the anode in a solution of litharge in caustic. When this solution is electrolized, clouds of litharge are evolved close to the plate. This is very curious, for if the solution is plumbite of lead the electro-negative radicle would be $Pb\,O_2$, not Pb O; such a salt being presumably $Na_2\,Pb\,O_2$. Peroxide of lead deposited from solution of litharge in caustic is too dense to be used as an active coating; it was proposed to use it to protect the iron, and to have then applied a coat of porous peroxide such as is used in acid cells. The peroxide was never satisfactory. To make up for the imperviousness of the peroxide, red lead and water were rubbed into the pile of velvet; the velvet was placed with its face against the iron plate, and the coating was oxidized in an alkaline solution. The velvet was then dissolved out by strong alkali, so as to leave a coating with a very large surface. This plate, however, had very small capacity. Electro-gilding the iron was then resorted to. It is a little difficult to gild iron, as the gold does not stick well. After each coat of gold the iron was heated to make the gold sink in. The gilded plates did not answer well. The Bower-Barff process for protecting iron from rust was tried, by getting an ornamental railing top and making it the anode in a cell. The black oxide did not prove to be a good enough protection. The strange thing about the corrosion of iron in alkaline solutions is that it does not take place if there is no coating. A piece of sheet iron may be used as anode in the solution of carbonate or bicarbonate of soda without being the least corroded; but if a coating of, say, white lead is applied, green spots appear at once, but only under the white lead; the back of the plate remains quite clear. Oddly enough, sheet tin is not easily attacked by an alkaline solution. Sometimes it turns black, or the surface, which consists of an alloy composed chiefly of tin, peels off in black scales. Sheet tin behaved much as iron and nickel; that is to say, it behaved very well till a coating was put on, and then it was corroded. There is a very curious alloy of iron and tin. If iron and tin are melted together, the resulting alloy separates into two portions; one is approximately Fe Sn, and the other consists chiefly of tin, and has a low melting point. The alloy Fe Sn solidifies at a red heat. It was too unmanageable to be of much use for batteries, and it was no better than sheet tin; but it was so hard that a straw-hardened cold chisel even would not cut it, but broke in pieces, while a softer chisel turned up at the edge. This alloy might be useful in commerce. The writer has since tried to make more of this alloy for some experiments on persistent magnetism, but has never succeeded in making it so hard again.

Iron without a coating is not attacked in such solutions as potassium bichromate, or permanganate. At first sight this seems strange, but it must be remembered that such salts owe their corrosive properties, especially when acting on organic bodies, not to the strength of their acid radicles, but to the electro-positiveness of chromium and manganese, which makes them combine energetically with an acid radicle to form chromium or manganese salts. Thus potassium bichromate or chromic acid in the presence of sulphuric acid is a very powerful oxidizing agent, but if there is no acid present to form a chromium salt it is no longer energetic. Iron in alkaline solutions is very convenient for adjustable water resistances.

We worked at iron cells with some tenacity, because we seemed to be very near success; and if we could make a peroxide plate with iron without local action, the negative might be of zinc, as this combination gives a high electromotive force.



Dynamo in the Continental Hotel, Paris.—(See page 8.)

CELLS WITH ZINC.

Evidently, cells with zinc could not be used in most acid solutions, as so many of its salts are soluble. Secondary batteries with zinc plates have often been brought out; but as the zinc dissolved on discharging is not deposited on the same part of the plate on charging, these cells cannot well be used very often. M. Reynier has lately worked at cells with zinc in sulphuric acid and Planté peroxide plates. He does not say how he proposes to get over the difficulty of the zinc being deposited in the wrong place He says that the deposited zinc is so pure that there is very little local action. His cells give 2.37 volts.

We tried plates with reduced zinc coatings in alkaline solutions that do not dissolve zinc, such as sodium carbonate and sodium bicarbonate. The coatings were made of oxide or carbonate of zinc. The chief trouble was the proper reduction of the zinc. These salts of zinc behave very much like lead sulphate—that is to say, they are very bulky—and the coatings form hard white cakes, which are not in good contact with the support. When the zinc is eventually reduced, it is very soft and loose. Very likely we made a mistake in reducing coatings of oxide or carbonate of zinc, instead of forming the coating out of the solid plate by attacking it when used as anode. The object aimed at was the use of iron for the support of lead peroxide in the other element; but as we did not get iron to work satisfactorily, we did not do very much with the zinc.

PRIMARY CELLS.

A few experiments were made, but they are not worth recording. Lately, however, the writer saw a note in the *Electrician* to the effect that a French savant had used agar-agar jelly in a Leclanché cell. It seemed possible that the use of this might avoid the necessity for a porous pot in a two-fluid cell, the idea being that to make up a cell one might take a zinc plate, place on it a wad of zinc sulphate jelly, place on that a wad of copper sulphate jelly, and cover it with a copper plate. Zinc and copper jellies are easily made, but the drawback is the rapid diffusion of the copper salt. Some cells were made with zinc filings suspended in a zinc jelly, so that any wandering copper salt might be caught before it reached the zinc plate. As rapid diffusion is always the result of a low-resistance porous cell, it seems useless to try to make a low-resistance two-fluid cell unless some colloid oxidizing agent can be found. Some of the solutions of iron were found by Graham to be colloidal; perhaps something might be done with them.

A bichromate jelly cell was tried, but it was also a failure. The same thing was noticed as in the case of flannel and cotton. Bichromate jelly with no acid keeps for any length of time; and sulphuric acid jelly can also be made; but the jelly dissolves at once if both acid and bichromate are present. The same thing happens with potassium permanganate.

Agar agar is a fucus or sea-weed. It has, if the writer is not mistaken, the same composition as starch. It has a very high gelatinizing power—about ten times that of gelatine. It is probably used for sizing paper or calico, or for cooking Mr. Stanford, of Glasgow, is an authority on the uses of sea-weeds.

Gelatine was tried, but it was liable to go bad, and was at once attacked by oxidizing agents.

Probably gelatinous silica may do, but the writer has not yet made enough experiments to say. A low-resistance bichromate cell in which the bichromate had not access to the zinc would be very useful where a large power is occasionally required, as in the laboratory.

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NEW YORK, APRIL 16, 1887.

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It is the wise man who lets severely alone those electrical schemes in which stock sales are the leading feature advertised.

It may be of interest to seekers after practical information to know that a common compass held under a wire, over which a current is passing, can generally be made to tell the fact. If the wire runs north and south, or nearly in that line, the needle will be deflected either to the east or the west, governed by the direction of the current. Now, place the compass above the wire, and the needle will show a deviation in the opposite direction. This is not given as a discovery or a wonderful scientific fact, but a bit of information which has and may again prevent a possible loss of life from the careless handling of wires supposed to be harmless.

Now that the carbon combination seems to have fairly well combined, the twelve and fourteen-hour carbon pencils should be heard from.

Some primary battery exploiters claim the earth. Still, it is evident that they don't want the earth all to themselves, for you can purchase all the stock you can pay for, but not any of the batteries with which to prove or disprove the claims of the promotors.

In Berlin the Chamber of Commerce has made a formal complaint to the post-office and telegraph department of their telephone service. The counts in the complaint are: Too slow; things get mixed; lines are often down; can't hear good. If the Berliners could only try the exchange at —— but never mind.

The first annual meeting of the Electric Club, New York, will be held April 21st. From a small beginning of less than half a dozen members this organization has grown to a membership of 200, comprising the best men in the electrical business in the United States. The REVIEW congratulates the managers of the Club on the great and unprecedented success their intelligent work has brought about.

Bombay doesn't seem a very good place for an electric light plant. For eight months of the year there is but slight trouble because of the extremely dry weather. But in the other four months—the rainy season—the insulation, unless of the most expensive and perfect kind, and with the best known installation, is good for nothing. Even in pipes the condensation grounds the lines badly. In addition to this, during the eight months daylight lasts as long as people want it, and in the other four the people do not work nights at all, so that, take it by and large, Bombay is not a very good place for electric lighting.

The diffusion method of arc lighting has many particular advantages In low-ceiled rooms, where the arc lamps must be hung close to the ceiling, the usually employed system does not properly diffuse the light. It is essential to have the ceiling and walls, if not white, of a light color. The lamps are so attached that the lower carbon is positive. The light is, therefore, thrown up instead of down, and being reflected in every direction, a very even and steady light is the result. A globe need not be used, and in that case less light is lost in being reflected from the ceiling and sides of the room than is absorbed by an opal globe in the usual method. Slight variations in the candle power of the light are scarcely noticed.

Our esteemed contemporary, *The Electrician*, of London, publishes in full Mr. Rudolf Eickemeyer's Electric Club paper and comments as follows:

"At a recent meeting of the Electric Club of New York a paper of singular interest was read by Mr. Rudolf Eickemeyer. Mr. Eickemeyer modestly describes himself as "an amateur not so very familiar with the technical phraseology of electricians," and it must be conceded that the paper does to some extent bear evidence of this fact (as, for instance, in the use of the term current where, strictly speaking, E.M.F. is intended). But this circumstance does not in any sense detract from—in fact, it considerably enhances—the interest of the communication, seeing that Mr. Eickemeyer, by a well-thought-out and consecutive series of experiments upon the magnetic circuit, has arrived at views which are for the most part practically identical with the latest developments of theory and practice in our own country. It is additionally interesting to note that Mr. Eickemeyer eventually arrives at a type of machine which carries out to its fullest extent the hint recently given by Prof. Forbes, to magnetize the armature rather than the field."

Mr. Eickemeyer's patent was filed in the United States Patent Office two years ago last March, therefore the "latest developments of theory and practice in our own country," of which our English contemporary speaks, were considerably antedated in this case. One other thing, *The Electrician*, unintentionally no doubt, failed to credit the source from which it obtained the Eickemeyer paper and illustrations.

A novel application of electricity is shown in a pharmacy at Berlin To prevent mistakes in dispensing medicines, each bottle which contains highly deleterious or poisonous drugs is made by its own weight to hold open a circuit closer connected with a battery and vibrating bell. The weight of the bottle being removed, the push button beneath it rises by the force of a spring, and contact is made. Of course, when the customer and the clerk both hear the warning bell, attention is at once called to the label, and an error may thus be corrected before it is too late.

In the early days of arc lighting much experimenting was done with small arc lamps of simple and inexpensive mechanism. The difficulty, however, of running these in series, and the success of the conventional form of arc lamp of the present day, discouraged inventors from attempting to devise a lamp of different construction. Then, too, many of the smaller arc lights or candles must be operated without feeding mechanism or with slight movement of the carbons, thus requiring an alternating current. For if the carbons are placed side by side one will burn twice as fast as the other if a direct current is used. Now that the introduction of the converter systems supplies a low tension alternating current, there is no reason why small arc lights of 50 to 150 candle power should not become popular.

The genus Inventor has many representatives. A weed is a plant in a wrong place. What shall we call those conjurors of nature's laws, who would be in their proper element if they were pulverizing rocks on the roads, or who are more experienced in the currents of anything but water than in the wondrous ways of the electric fluid? Such a one is now dazzling the cute ones of the Bay State. If gas be mixed with a few volumes of air before being burned the flame is colorless, not smoky, and intensely hot. A burner for accomplishing this was invented years ago by Bunsen, and now bears his name. The more modern inventor of whom we speak has arranged a gas stove provided with Bunsen burners. These require 1 cubic foot of coal gas and 8 feet of air per hour. Of course the flame is intensely hot, does not deposit soot, and is non-luminous. He claims that while using but 1 foot of gas he obtains the same heating effect as if 9 cubic feet of gas were used without air. A stock company with a capital of $5,000,000 may be expected, higher barometers followed by local rains—when the stockholders find how they have been fooled

There is no subject better worth the attention of engineers and practical mechanics than practical electricity. With the present spread of electrical appliances there are few who may not be called upon to manage or superintend electric plants of some form. It is no wonder that one is discouraged from the study of the subject. It certainly appears difficult while the task is easy. First read the electrical papers, and in addition take up one subject at a time, magnets, batteries, dynamos, insulation, etc., and read and study all that can be found bearing on the subject. Of course a first reading may not give a perfectly clear idea of magnets for instance; but a review and re-review, after a general study of the entire subject, will make all clear. Among the many valuable books may be mentioned: "Ayrton's Practical Electricity," "Fleming's Short Lectures to Electrical Artisans," "Thompson's Elementary Lessons in Electricity and Magnetism," "Jenkins' Electricity and Magnetism," "Gage's Physics." Taking any subject for a week's study, read carefully and compare what is given in each book. Another week a new subject may be taken up, until the whole ground is covered. The services of a teacher are desirable, but few who are competent to give instruction of real value are not busy with more profitable work, and the use of a number of text books on one subject offers many of the advantages of a teacher. If a few form an electrical society for regular meetings and discussions, many electricians of experience would, on invitations, read papers on electrical subjects.

INCANDESCENT LIGHTING FOR PRIMARY BATTERIES.

Not a long time ago almost all real or quasi electricians asserted that incandescent lighting by means of primary batteries could never be made a practical success, that the cells would need a fresh charge of liquid every few hours. Practical tests shown during the past year have demonstrated that primary battery lighting has a great future. Though it may not be on the basis of price a competitor of gas, still in every other respect it is superior. It is now claimed that in towns or cities where the gas rate is high it will rival the latter on the score of economy. The cost of running a 16 candle power incandescent lamp is estimated to be from 1 to 3 cents per hour, depending on the style of battery, its management, and the efficiency of the incandescent lamp used. As the field for invention in chemical batteries will be crowded by experiments during the next year, it may not be amiss to suggest certain points the improvement of which will still further advance the success of incandescent lighting on a small scale. A method of making contact with the carbon pole of less resistance and proof against corrosion from the fumes of the liquids or from chemicals drawn up by capillary attraction; an inexpensive and simple process for making large carbons in the form of a cylinder, and the corrugation and piercing of the same with holes to give increased surface; an acid proof coating to be applied to wooden boxes to be used as cells or an improved method of burning or uniting lead to be used as lining of same; porous cups of less resistance, and if possible at the same time less porous, whereby the danger of the depolarizing liquid reaching the zinc is lessened: a cheaper depolarizing material than nitric acid or chromic acid. As the latter is made by the addition of sulphuric acid to bichromate of soda or potash, any reduction in the price of these would accomplish the same result. The use of bichromate of calcium or barium has been suggested, and if one or both could be manufactured cheaply they would be much used, as the useless sulphate of calcium or barium, would be precipitated on the addition of sulphuric acid. Depolarizers which absorb oxygen from the air and become oxidized after a short rest and become reduced anew when the battery is used are well known, and there is required only careful experimentation to make the system a success.

The question asked by Pliny Norcross, on page 3 of the REVIEW of April 2, "What is the best way to put an arc wire through a brick wall?" is a pertinent one, has been asked many times, and been answered quite satisfactorily, where this plan can be followed, by cutting a hole sufficiently large to carry the wire through the air space without touching. If the wall is one where this cannot be permitted, then, whether the partition is a brick, plaster or wooden one a large-sized porcelain insulator, nicely fitted either side of the wall, gives a better insulation than soft or hard rubber, because either of these may, under some circumstances, burn. The insulators so placed may be fixed in plastering with plaster of paris; and in a wooden partition, by taking one turn of tie wire round it; the insulator may be fastened to the wall by a staple tack In the Sherman House, Chicago, the wires are carried through the heavy walls by being strung through insulators in this way. In reply to the other query in the letter, to re-insulate underwriters' wire would cost more than to purchase new. At best, that form of wire is miserable enough, and it is doubtful if it isn't about as safe without any such wrapping as with it.

We are informed that the Forest City Carbon Company, of Cleveland, and the Solar Carbon Company, of Pittsburgh, have not agreed to enter the carbon combination, announced in the REVIEW last week. This information, which was given exclusively in this journal, was a surprise to the electric lighting fraternity. Just what the effect will be the future will soon unfold, but there does not seem to be any great uneasiness on the part of the consumers.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

There is just now in Chicago a wonderful amount of speculating as to what is to be done for the accommodation of our pedestrian travel. Morning and night the cars are so overcrowded that the Irishman's remark, "Anybody who rides home to-night, bedad, will walk," is verified daily. The street car people have put on all the conveyances they can without making an almost connected train of street cars, and the trouble gets worse daily.

So every few days somebody suggests a railway—overhead or underneath—to take care of the overflow. So, too, every time anybody suggests this, another somebody comes to the surface with a new, perfect, complete and universal, warranted, guaranteed system of electric railway, which no one ever heard of before, and probably never will again, unless it happens to be in the courts by and by.

We are having two of that kind of experiences now, and there is considerable amusement to be got out of modest inquiries around the scrapheap where one of these is getting ready to astonish the "rowdy West," or the impossibly combined system of the other. It is safe to say that stock is for sale in both instances, and it is almost as certain that

"Who enters here leaves hope behind."

We do need, and must have, by and by, some method of getting into and out of the west and north divisions, far easier and more rapidly than now, and electricity will have to do it in some form; but it will never be done by the systems which are just now being exhibited as above.

The most extensive and complete burying of wires anywhere in the United States is to be found in Chicago. Those who have a memory of the streets as they were a few years since, with their long lines of poles crowded with cross-arms and loaded with wires, would to-day be astonished at the progress which is being made in getting the lines underground.

The last report of wire mileage, some time last fall, showed that there were then about 3,000 miles of underground lines here, and they have been going down ever since. LaSalle, Clark, Washington, Randolph, Madison, Monroe—in fact, all the streets between the main river and Van Buren street, and the South Branch and the lake, have hardly a pole left with live wires, and the dead lines are coming off rapidly.

And this brings up the fact that out in the Pacific States and territories, where the weather is more favorable to that sort of exploiting, the barb wire fence is made to do duty as a telephone line to some extent. The language comes out at the further end pretty ragged sometimes, but that is assumed to be the fault of the irregular course of the conductor.

The Chicago Council, at its last meeting, previous to the incoming of the new organization, placed the electric lighting ordinance, through which it was hoped the rivers would be lighted, on file. On file means on a shelf for one blessed year at the least.

On the 7th instant the Milwaukee Avenue Electric Company was incorporated with a capital stock of $30,000, by A. L. Baker, Chas. R. Webster and Wm. W. Case, of Chicago, and there were incorporated on the 8th:

The Streator Manufacturing Company, at Streator; capital stock, $10,000, to manufacture electric augurs. Milton Hicks, Z. O. Jackson, and D. Heenan.

The Wanless Manufacturing Company, of Chicago; $300,000 stock; for manufacture of electrical appliances Thomas Wanless, E. B. Hamlin, and Jno. M. Hanless.

The Chicago Edison Company, $500,000 capital stock; Jno. M. Clark, Jno. B. Drake, and Robert T. Lincoln.

The disposition innate in mankind, to charge some incompletely understood force with mischief, is probably coeval with the first summer in the garden of Eden. Franklin's lightning rods were expected to draw the wrath of Heaven upon such as were daring enough to use them. For that matter, as they are generally put up, that sort of prophecy is not very far out of plumb.

But the latest application of the principle referred to was a case told not long ago by an electric light man who happened here on business. Said he: "I had a new building cut home all wired, and was nearly ready to start up. The painters had left a lot of their oiled rags, overalls, etc., on the floor in the upper part of the building. Of course they caught fire and the wires under the floor were laid bare.

"You ought to have heard the red-shirted fire worshiper explain the dangers of those wires. They set it afire; of course they did!

"But when I showed him that the wires were not connected with the dynamo, and the dynamo was not connected to the engine, and there was nothing in the furnace but mortar and iron to make a fire with, why, he kind o' took water; and so did I, but it was mixed."

Mr. W. H. Johnson, the well known electrical mechanician, recently of Louisville, Kentucky, has taken charge of the construction department of the Electrical Supply Company here, with headquarters in Chicago.

The changes which are constantly occurring in electrically lighted district, are nothing short of remarkable. Changes from arc to incandescent, from one system to another. Marked changes have taken place in Chicago in this respect in the past two years.

For instance, in December, 1885, the first Ball machine made its appearance here, and was looked upon as a curiosity, if not a paradox. It has shown that it is here to stay. A 20-light plant, with fifteen lights, running sixteen hours per day, has been in constant use from that time to the present, and has never been found wanting. A plant of the same capacity put in on the combination system in May of last year, at Grommes & Ulrich's, has 12 arc and a lot of incandescent—some twenty or twenty-five in number—on a Sun distributor. The Wunder & Abbott Illuminating Company are running some 260 arc lights; the Pullman Palace Car Company are using eighty of the same kind, at Pullman, Illinois. In the case of the first two plants not a cent of cost has been paid for repairs, and the later plants are equally satisfactory, so far.

CHICAGO, April 11, 1887.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

"I tell you the decision of the Supreme Court will be favorable to the Bell Company," remarked a gentleman, well informed in electrical matters. "I have seen the same thing occur so often."

"What makes you think it will go that way?" was asked.

"I've noticed many a time before the decision of the Supreme Court in a patent case, that the stock would gradually go up, climbing point by point if the decision was to be favorable to that side, and that a steady drop was always followed by an unfavorable decision. You see that many speculators are mind readers, and they get a faint impression of the decision, and buy or sell accordingly."

He rushed out of the door to meet his friend B. Rush, whose mind he read was to ask him to take dinner.

In all the discussion of the Bussey bridge accident, on the Boston and Providence Railroad, little has been said about the hammer blow of locomotive drivers on the track or supporting structure. The inertia of the crank pin and connecting rod is sufficient to give a severe blow to the track, unless a counterbalancing weight is placed on the wheel, and this is sufficient for a certain speed only. It is generally admitted that the weight of the locomotive and the hammer effect of the drivers always weaken the structure so that it yields under the weight of the cars behind, even if it does not fall at once. The advantages of electric propulsion, with motors under each car, making every bridge in New England absolutely safe for any load which can possibly be put upon them, are becoming well known among the community. The first practical electrically driven car will be shown in operation in a few weeks on the rails of the Cambridge Railroad.

Negotiations are in progress with the Boston Electric Lighting Company with regard to furnishing current at various points in the city to charge storage batteries. A perfect automatic switch is provided with each battery, which is by this mechanism automatically switched in and out of circuit when the cells have become discharged or charged. Not the slightest attention is required for the more perfect devices of this description. The batteries become by purchase the property of parties using the lights, and the amount of current used in charging is estimated by a time meter, which has been tested for a long period in use in Boston. The charging will be done on the regular arc light circuits, and, as the current used is constant, the amount of current is easily estimated from the reading of the clock.

Electric power is not, like electric light, in less demand in summer than winter, and the use of electric motors is rapidly increasing. The New England office of the Sprague Motor Company have made the following installations in Boston: Leach, Annable and Company, 2½ horse power combined passenger and freight elevator; Knickerbocker Building, 129 Tremont street, 7½ horse power, pumping against pressure tank for hydraulic elevator; Morely Button Sewing Machine Company, 1 horse power; S. E. Cowles & Company, 18 Arch street, 2 horse power printing presses. The Edison Illuminating Company, of Brockton, is being rebuilt and enlarged, and electric power is to be furnished. The Middletown, Conn., Electric Light Company are installing as an auxiliary to their arc plant, a 1,500 light Edison plant, and will furnish electric power. The Essex County Electric Light and Power Company (Haverhill, Mass.) have replaced a 76 volt Thomson-Houston plant of 700 lamps, with a new dynamo of the same system of 100 volts, as they are to enter upon the power business. The Middlesex Electric Light Company, of Lowell, Mass., are adding to their arc plant Thomson-Houston incandescent machines, and will run day circuits to supply power. The Worcester Electric Light Company are adding to their power circuits constantly.

BOSTON, April 12.

Announcement of the Annual Meeting of the Electric Club.

The following notice has been sent to all members of the Electric Club:

The first annual meeting of the Electric Club will be held Thursday, April 21.

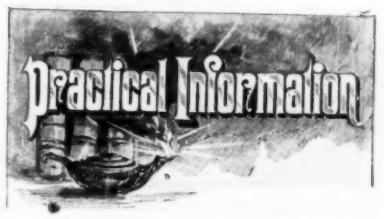
The polls will be open for the election of officers from 4.30 to 6.30 P. M. Copies of tickets placed in nomination are enclosed. Only resident members present, not in arrears for dues, can vote.

Dinner will be served at 7 o'clock, followed by responses to toasts in honor of the occasion by Mr. C. L. Buckingham, of New York; Mr. C. J. H. Woodbury, of Boston; Mr. W. S. Hine, of New York; Mr. H. J. W. Dam, of New York; Dr. Otto Moses, of New York; and music by Mr. Geo. M. Phelps, Jr., and Lieut. F. W. Toppan, of New York.

Mr. Marshall P. Wilder, the great humorist, will present his unique after-dinner entertainment.

It is imperatively necessary that the secretary receive early notice on the enclosed card from all who intend to be present, so that the necessary arrangements may be made.

The entertainment committee will wear white rosettes.



Paraffine should never be heated above the temperature of boiling water; at a higher temperature it is partially decomposed, and its resistance diminished. It is well to warm the vessel containing it by means of a water bath in the same way glue is usually heated in an ordinary glue-pot.

Dr. Muirhead gives the following for a good insulating varnish: Obtain button shellac, pick out the cleanest lumps, and dissolve them in absolute alcohol. Allow the solution to stand for some time, and use only the upper part of the solution. When the highest insulation is required, first dissolve the button shellac in ordinary alcohol, and precipitate it by allowing the solution to trickle into distilled water; then dissolve the precipitate, when dried, in absolute alcohol.

CLARIFYING SHELLAC SOLUTIONS.—Shellac contains 1 to 5 per cent. of wax, which is the cause of the turbidity of the solution, which can be cleared by the following process: Shellac 1 part, is dissolved in alcohol, 8 parts, and allowed to stand for a few hours. Powdered chalk is then added in quantity equal to half the weight of shellac in the solution, which is heated to 80° C. or 196° F. The greater part of the solution clears rapidly, and the remainder may be clarified by once filtering.

QUERIES AND ANSWERS.

To the Editor of Electrical Review:

1. Does Ohm's law apply to finding resistance in glow lamps, as in case of arc lamps?

2. By what formula can I find resistance to current in Edison system when potential is 110 volts and resistance of lamp carbon is 125 ohms?

3. What is gained in 3 wire system of Edison over coupling same dynamo on two wires?

4. In what form was Wheatstone's bridge made originally?

5. Is it possible to obtain a current of 300 volts from a constant current dynamo, giving off 100 volts? Can this be done by means of induction coil? W. S. COON.

JACKSON, MICH., March 30.

ANS. 1. Ohm's law applies to finding the resistance of glow or incandescent lamps, the resistance—the volts—divided by the current, or $R = \frac{E}{C}$. This does not hold in the case of arc lamps. An arc lamp of 50 volts, ten ampere, would by this formula have a resistance of 5 ohms. It apparently has that resistance, and for most computations must be considered as having that resistance. The positive carbon is hotter than the negative, and a counter electromotive force is set up, which decreases the current in constant potential circuits, and which increases the difference of potential in constant current circuits, thereby making the lamp appear to have a resistance of 5 ohms, while the real resistance of the arc might be not far from one ohm.

2. The resistance in this case is that of the lamp (125 ohms) and that of the conducting wires and contacts, which amount may be neglected.

3. A saving of over 60 per cent. in the weight of copper used for the mains.

4. Same as the one in use at the present day. The lozenge form of diagram is used for explanation purposes only.

5. Use an induction coil having from 5 to 10 times as many turns in the secondary as in the primary. By means of a suitable device rapidly reverse the dynamo current in the primary circuit. The current obtained from the secondary circuit will be alternating.

Telephonic News

Behold the Man!

Oh, gaze on the youth
Who so warmly embraces
The tree that is stripped of its bark;
He throws out his limbs
Like a wild colt in the traces,
And observe how he maketh his mark.
Note his cheek! (*Yes, do.*)
How it alternate pales and turns red,
And his breath, how it comes hard and fast.
Oh, think you this poor youth is losing his head?
Have his good days of sanity passed?
Bend low, and the secret I'll whisper to you;
Bend low, 'tis a secret sublime—
The youth you behold has *excelsior* in view:
He's a lineman just learning to climb.

—SPUR.

*** A new telephone line, via the New Haven and Derby turnpike, is being constructed between Derby and New Haven.

*** The Hess guest call is now in great demand. It certainly proved the means of saving many lives at the Richmond Hotel fire.

*** Superintendent Mason, of the Police Telegraph, Brooklyn, has a staff of seven men engaged in answering telephone calls, and has noticed that the left ear of each is from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch closer to the head than the right. All telephone calls are heard through that ear, and the act of so constantly pressing the receiver against it has caused the change in the set of the ear. There is a valuable hint in this discovery for people with wide-spreading ears.

*** "Economize! that's what I've been doing in my business," remarked a hardware dealer in a suburban town, "but I can't afford to dispense with my telephone, even if it cost me three times as much." Such is the general testimony. Still some of our mossback legislators, who don't realize that it costs more to run a large telephone exchange than a small one, because more can be reached; just as the tax rate in a large city is more than that in a small town, long to upset the laws of gravitation and regulate the cost of politeness and make electrical talking cheaper than their own.

*** The telephone in a Fulton stree butcher shop rang out violently yesterday, and the democratic man of meat answered it. "Is that you, butcher?" came over the wire. "Yes'm." "Well, send up to No.—— Clinton avenue a nice roast of beef and a couple plump chickens, and be sure and get them here early." "Bet your bustle I will." "What's that?" "You can just bet your" —— "Do you know who you are talking to, sir?" "Mary, the cook; ain't you Mary?" "No, sir, I am not Mary; I am Mrs. ——, and this is the last order you'll" —— "'Scuse me, mum; that bet's off."

*** The position in which the body of Mr. Robt Boyd, special agent of the American Bell Telephone Company, was found in the ruins of the Richmond Hotel, Buffalo, is thought to be satisfactory proof that he never awoke, and perished without awakening to the agonies of a fiery death. The charred remains were found on the bed springs. The death of this greatly esteemed gentleman is sad indeed, but it is a source of relief to his friends to be informed that he probably did not awake, being a very sound sleeper, to suffer from the flames. The remains were interred in Boston on Wednesday last.

*** The following interesting advertisement has appeared in the Washington *Press:*

FOR SALE.—Two hundred thousand dollars Rogers telephone stock, Pennsylvania branch of licensed, and guaranteed to be defended by the Pan-Electric Company, whose case is being prosecuted by the Government, under President Cleveland, against the American Bell Telephone Company, and whose chief stockholders are United States Attorney General Garland, also attorney and counselor for the Pan-Electric Telephone Company; Railroad Commissioner Gen. Johnston, President; Senator Harris, Vice-President; the Hon. Casey Young, Secretary, and Gen. Atkins, Indian Commissioner. This offer of telephone stock presents a rare opportunity, as it cannot fall much lower than thirty cents in $100,000 under the present administration, and may go to par if the Government succeeds, for there is no tax on the stock. The United States furnishes all the money, Thurman, Thompson, Jenks, Hunton, Lowery, Jeff Chandler, and other great counselors making the fight.

Electric Alarms in Hotels.

If hotel men cannot afford to build fire-proof hotels, they should at least provide every means of escape and all the latest electrical alarms to notify guests of impending danger. Had not an electrical fire-alarm communicating with every room in the house of the Richmond Hotel, burned at Buffalo last week, awakened the guests, the loss of life would have been at least five times as large as it was. So rapidly did the house burn that even the instantaneous alarm of the "Hess system" of fire-call could not save them all, but, as the testimony shows, what the result would have been without such an invention is appalling to contem plate. That such a serious loss of life resulted in face of the fact that an alarm bell was ringing in every room from the instant the clerk became aware of the fire, proves that the Richmond Hotel must have been even worse constructed than the average fire-trap hotel. In the absence of fire-proof hotels, what is demanded of hotel men is careful management and the providing of every possible precaution and improvement that shall make human life safe in case of emergency.—*Hotel World.*

The Buffalo Committee.

The coroner's jury in the Richmond hotel fire case was very positive in its recommendation that the wires be put underground, and it is highly probable something will now be done. A committee of the Council had been appointed previous to the fire, and on the 4th this committee, by its chairman, Alderman Scheu, reported to the Council. The committee, in its inspection of the underground systems of New York, Brooklyn, Philadelphia and Boston, was accompanied by representatives from the Bell Company and the Brush Company at Buffalo.

After detailing their experiences in the above cities, the report concludes with the following summary:

That after visiting the cities in question and examining the various systems of conduit in use, and considering the large number of patents issued in respect to the subject, it was a matter of great surprise to the committee to find that while a number of wires are placed underground, but very few overhead wires have been removed, and not a pole has been taken down. That the telephone companies only have thus far shown any willingness to place their wires underground, and that the telegraph companies have shown no desire or intention to do so until compelled to.

The committee is of the unanimous opinion that the overhead wires in the thickly settled portions of the city can be and should be placed underground, and as speedily as possible. That to do so in this city will be comparatively easy, owing to the width of our streets and their freedom from rock. In view of the fact that there are 480 patented conduits and the wooden conduit which is not patented and which is most generally in use, the committee do not deem it wise to recommend any particular kind, except that it should be a comprehensive and inclusive "drawing in" system of insulating material, and that the electric light wires should be placed in a separate conduit at a safe distance from the telephone and telegraph wires, and with separate manholes.

That provisions should be made for the wires of all present and future companies to use the conduits, as well as for the increasing service of each, and that the fire alarm and police telegraph wires should be conducted therein free of cost to the city.

The committee do not apprehend any danger of creating a monopoly, as it seems generally conceded that, aside from the cost of cables, wires can be maintained in conduits much cheaper than in the air, and that the different companies if compelled to undertake the first expense, will, from self-interest, select the conduit best suited to the general purpose.

The corporation counsel has prepared an ordinance which we submit herewith and recommend its adoption after the passage of the act now pending in the State legislature.

In order that there may be no further delay after the act pending in the legislature in respect to wires becomes a law, we recommend that the common council determine and define in advance the portion of the city in which the wires shall first be removed from the streets.

Telephone Companies Enjoined at Rochester.

SUIT FOR INFRINGEMENT INSTITUTED BY THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON.

A short time ago the American Bell Telephone Company, of Boston, began an investigation of the business of the Rochester Telephone Company, and the Buffalo Telephone Company, of Buffalo. The result was the commencement of an action for infringement of patent. The proprietors of the two companies are said to be H. S. Johnson, William L. Horton and DeL. Harris. Johnson and Norton, it is claimed, conducted the business in Rochester, and Harris had charge of the Buffalo office. The three proprietors were served with an iron-clad injunction order granted by Judge Coxe, of the United States Circuit Court. The court order restrains the defendants from manufacturing, using and selling telephones and from moving instruments now placed in any building. The affidavits on which the order was granted allege that the defendants have been making and selling almost an exact copy of the hand receiver used from the beginning by the Bell Telephone Company. The instrument was sold, it is alleged, for a transmitter and receiver. The affidavits set forth that the defendants have been careful not to disclose any more of their business to the public than was absolutely necessary. Their offices in Rochester and Buffalo had been kept as secret as possible and the defendants made no attempt to sell telephones in either city. Their manner of conducting their business was, it is alleged, to send out circulars and receive orders by mail, concealing their identity by working under corporate names. Their purpose, the affidavits set forth, was to sell infringing instruments and let the purchasers run the risk of becoming defendants in a suit for infringement. The defendants have been in business several months and, it is said, have done a thriving business. They sold telephones for short circuits.

Death of Daniel Davis, a Pioneer in Electrical Work.

This gentleman died at Princeton, Mass., Tuesday, March 22, at the age of seventy-four. Probably no man in this country had such a thorough knowledge of electricity forty years ago as Mr. Davis. Born in Princeton, of a mechanical family, he worked on his father's farm until he was twenty-one, and came to Boston in 1833. His first work in this city was pumping soda for Mr. Darling, who then had a large soda factory in Franklin avenue. Being greatly interested in electrical experiments, he soon became acquainted with Dr. William King, who had a shop on Cornhill, who manufactured static electrical machines and also constructed and put up lightning rods. Mr. Davis soon found employment with him. His first job was constructing and putting up the rod on the court house in Boston. This was made of flat copper ribbon, and is now in as good order as when first placed in position. He also constructed and put up the rods on the buildings in the Charlestown Navy Yard. In 1835 he began business for himself at No. 11 Cornhill, in partnership with the late John Temple, under the firm name of Davis & Temple. In 1837 Mr. Davis bought out the interest of his partner (Mr. Temple afterwards became the well-known mathematical instrument maker), and commenced the manufacture of electro-magnetic apparatus. At that early day there was no practical use for electricity, and his principal business was manufacturing and constructing apparatus to illustrate the general principles of voltaic and dynamic electricity, and in connection with the late Dr. Charles G. Page they invented many of the electric circuits, movements and machines that are now in use. They continued their experiments together until the fall of 1839, when Dr. Page accepted a position in Washington as examiner of electric patents. Mr. Davis' business increased very rapidly, he being the only man in the United States at this time who made electro-magnetic apparatus. In 1842 he published "Davis' Manual of Magnetism," this being the first work published on that subject in the world. It was used as a text-book in all the principal scientific institutions in this country and England. He was a man who did not believe in patents. Had he patented some of his inventions he would have died a millionaire. He invented the art of electrotyping in copper, wood cuts and type such as are used to-day, and gave his invention to the world. In 1846 he electrotyped in copper the arm of a child, which has been lately claimed as a new invention. This arm is still in existence. In 1840 Professor Gareaux, of Paris arrived in Boston with the invention of Daguerre. Mr. Davis made a set of apparatus and probably took the first daguerrotype taken in this country. Elias Howe, the famous sewing machine inventor, worked for him and made his first machine in his shop. Mr. Davis was also the first man in this country who did electro gold and silver plating, and taught the art. In 1844 Professor Morse had just introduced his telegraph, but it was a very rude and impracticable machine, and it was put into Mr. Davis' hands for improvement and he put it in its present state. He received several gold medals from various exhibitions for his inventions and skill as a manufacturer. His shop was the headquarters for professors, scientists and electricians for many years. The writer has seen Dr. Hare, Professors Webster, Hitchcock, Silliman, Henry, Abbott, Farmer and Channing, and most of the scientific men of the time in his store. Mr. Davis would be in his shirt sleeves trying some new experiment, with the professors crowding around him as much interested in his work as himself. In 1852 he retired to his farm in Princeton, where he passed the remainder of his days in agricultural pursuits. He was a kind-hearted man, and the soul of honor and integrity. T. H.

The Goddess of Liberty to be Well Lighted.

The Light House Board has completed arrangements for increasing and improving the illumination of the Bartholdi Statue of Liberty on Liberty Island. A strong lens will be placed in the torch, five additional electric lights will be placed around the base, making thirteen in all, and a number of incandescent lights will be placed in the interior of the statue. The light to be placed in the torch will be one of the most powerful fixed lights in the world. It is intended more for the purpose of enhancing the grandeur of the statue than as an aid to navigation, as a light of much less power than that selected would answer equally well for the latter purpose. The proposed work will be done under the supervision of Lieut. John Millis, U. S. Engineer Corps. Improvements are also contemplated at the base of the statue. An appropriation of $19,500 was made at the last session of Congress for lighting the statue and improving the surroundings.

Electric Lighting in Paris.

At a recent meeting of the Paris Town Council, it was suggested that the Town Council should establish a municipal service of electric lighting throughout the whole of Paris, and they have asked for the appointment of a special committee, composed of members of the Town Council and professional engineers and electricians, for the purpose of reporting on the best method of carrying out this idea.

The new police regulations regarding the installation of electric lighting in theaters and other public places, are viewed with great dissatisfaction by Paris electrical workers. They are extremely strict, and will tend to increase the cost and retard the progress of installation work. For instance, all lamps must be surrounded by wire netting (glow lamps not excepted), samples of all the conductors must be submitted, the plans of these installations have to be submitted to the Prefect of Police in triplicate, and the work must not be begun until permission has been given.

OUR TEXAS LETTER—A NEWSY LETTER FROM THE SOUTHWEST.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

Many of your readers will doubtless be gratified to know that in both Texas and Arkansas the efforts on the part of the legislature to pass bills regulating telephone rates have met with defeat. In Texas, through the skillful presentation of the case by General Superintendent Dunbar, of the Erie Company, to the Senate Committee, to which the bill was referred, it was reported upon adversely and never reached a vote. In Arkansas, however, where the bill was introduced by a member of the House, it has had a precarious time. It was first rejected at the third reading, then, unexpectedly, a motion to reconsider was adopted, and it went through the house, and to a third reading in the Senate, at a pace reminding one of nothing so much as Josh Billings' mare who begins to go down hill, when it would seem as if everything was "greased for the" occasion. Yesterday, however, came the information that the Senate refused to pass the bill by the decisive vote of twenty-eight to three To-day the Arkansas Legislature adjourns, and Monday next ends the deliberations of the Texas body, and for two years to come the telephone companies may pursue the even tenor of their way without fear of hostile legislation in these States.

I met here yesterday Ed. J. Smith, who, although yet a young man, is an old-time telegrapher. Away back in the sixties we rubbed shoulders together in the main office of the Western Union in Chicago. I can well remember the smile of incredulity which illumined the countenances of some of the "old timers" of those days at the pretensions set up for Smith by his friends, that he was a fast sender, but how quickly ridicule turned to respect, and I am sure there are men to-day, through whom will run a perceptible shudder at the thought of how Smith, in the solemn stillness of the night, on the old overland wire, has caused them to climb into the topmost branches, and "rushed" he "them, then, there," and if it didn't account for the milk in the cocoanut, it did for some pretty execrable copy. Parenthetically I may say I am something of a shudderer myself. Mr. Smith is publishing here a successful, bright and newsy weekly paper called the *Sunday Mirror*, in which may be often found well-chosen extracts from the REVIEW, which he assures me are always properly credited.

Speaking of "old timers" reminds me to say that I lately met in Galveston, Lewis F. Zantzinger. He may almost be denominated a pre-historic specimen of his class. He was one of the first to press a key on the line Morse laid between Baltimore and Washington. His relations with that eminent man were intimate, and there are now in his possession a number of autograph letters from Morse to himself, which are most interesting, and, of course, greatly valued by the recipient. Mr. Zantzinger has for many years been in the employ of the Morgan S. S. line as purser on one of their ships.

How injunctions do not enjoin in Texas may be a question which Judge Pardee will shortly be called upon to determine; ever since he granted the injunction prayed for by the Bell Company, affecting the Pan companies in Texas, and which became operative in February, another concern has been operating the exchanges in Dallas and Fort Worth, having leased the lines and apparatus formerly used by the enjoined companies. The instruments used, both receiver and transmitter, are mongrel affairs, the former but little unlike that in use by the Pan companies; the latter unlike—in form at least—anything before seen in earth, air or sea. In Fort Worth and Dallas the opposition have a combined patronage of between six and seven hundred subscribers. Rates are not very rigidly adhered to, and his, together with the local prejudices in favor of the home enterprise, have placed the licensees of the Bell Company at a disadvantage.

No town in this part of the country can be said to amount to much, just now, without a "boom," and a full-grown, healthy boom seems to have arrived here and at Dallas, with all its camp equipage, prepared for a long stay and a vigorous campaign. It would require the yearly stipend of an Inter-State commissioner, or a day's earnings of a New York plumber, to buy a lot in either place, which the eye of man, standing on the outskirts of the town, could not discover with a long range binocular. The future growth and prosperity of both towns, separated though they are by a distance of but about thirty miles, can hardly be a subject for speculation. Electric lighting is being given much attention, and I understand that in Dallas the Edison incandescent system is now being substituted for another, which failed to meet the requirements.

I cannot close this without alluding to Mr. Boyd's sad fate. Who that knew this genial, manly man but will mourn over his fearful, uptimely death? To many of us it comes as a personal bereavement. It seems such a short time since he was among us at the September gathering of telephone people in St. Louis, where none greeted, or were more warmly greeted than he. How many hearts will go out in loving sympathy to those left desolate by his tragical taking away. B. G.

Forth Worth, Texas, March 31.

Absorption of Light in Electric Conducting Media.

The increase of the conductivity of a body is connected with a decrease of the velocity of propagation of the light waves, but this latter means a decrease of the oscillations, that is, of the brilliancy, especially for refrangible rays. For white light, it would become reddish. The experiment made with gold leaf on a glass tube did not at all confirm this view, though possibly the course of the phenomenon may have been altogether altered by the fusing of the gold on to the glass.

Alteration of the Diameter of the Spark Discharge with Alteration of the Potential and Resistance.

The spark discharges took place between two platinum-coated spheres of 40 mm. diameter, and were photographed on glass, the photographs being subsequently measured with a cathetometer. It was found that for distances of 2 to 16 mm. the diameter of the spark increases as the square root of the potential, and decreases according to a hyperbolic function with an increase of the resistance, so that for a considerable resistance it becomes practically constant. If y is the diameter of the spark, x the resistance, and a, c, and h constants,

$$y = h + \frac{c}{a + x}$$

A Red-Hot Telephone Transmitter.

Professor G. Forbes and Mr John Munro have recently made some experiments with a red-hot wire as a telephone transmitter, an account of which has been communicatd to the Royal Society. A fine platinum wire, from .001 to .005 in. in diameter, and several inches long, was included in the circuit of a charged accumulator and the primary wire of an induction coil. A receiving telephone was connected in circuit with the secondary wire of the induction coil. The battery power was such, *Engineering* states, that the fine wire in the primary circuit was heated to a high temperature, and rendered incandescent. When in this condition, on speaking to it, the words could be heard in the receiving telephone. The explanation of the phenomenon is that the sound waves passing the incandescent wire in quick succession altered its resistance by cooling, and thus varied the strength of current in the primary circuit. The fluctuations of current thus caused excited corresponding fluctuations in the secondary circuit, and these reproduced the voice in the receiver. Spiral wires in the form of watch-springs, of steel and platinum iridium, were tried in place of the straight wire, with some success. An india-rubber diaphragm was also interposed between the voice and the heated wire, and found to influence the wire like the direct voice. Mechanical vibration did not affect the apparatus.

OUR ARKANSAS LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

Since writing you last, we have had some legislative experience. A bill was introduced in the Arkansas house similar to the Indiana law, reducing telephone rates to $3 per month, or $2.50 where two or more were used by the same party. It also reduced the tolls on territorial lines. It passed the house on a reconsidered vote, but, thanks to the hard work of Superintendents Dunbar and Baker, was defeated in the Senate, by the handsome vote of 28 to 3. We will now breathe easy for a couple of years.

This place is on quite a "boom;" in fact, the whole State is in the same fix. Real estate has doubled in value two and three times in the last month. Our mines promise also to become regular bonanzas, and there are about a dozen different new railroads proposed to and from here, in as many different directions; while if only half the different enterprises and improvements proposed are carried out, we shan't know ourselves, or the town, in another year. The telephone feels the influence of the boom, and we are getting a good many new orders for instruments, and hope it has come to stay.

RUHTRA.

Little Rock, April 4, 1887.

Fancy Bread.

An esteemed electrical friend sends us the following as a sample of what he can do. There is a poet here, undoubtedly :

"Oh, tell me where is fancy bred?"
She asked; and, getting bolder,
She laid her darling little head
Right down upon my shoulder.

And I, with no more poetry in
My soul than in a Quaker's,
Replied with idiotic grin:
"You'll find it at the baker's."

A Patent Soliciting Firm.

Mr. Chas. J. Kintner, late principal examiner in the Electrical Department of the U. S. Patent Office, and Mr. John A. Wiedersheim, have formed a partnership in the business of soliciting patents, their office being in the *Record* building, Philadelphia. Mr. Wiedersheim opened his office in Philadelphia just twenty years ago, and has devoted his time and talents to the interest of inventors before the United States and foreign offices. The increase in his business necessitated the services of expert talent, and to this end he has secured the co-operation of Mr. Kintner, whose reputation as an electrician and electrical expert is well known. Mr. Kintner's association with Mr. Wiedersheim will benefit inventors and others interested in electrical and kindred patent matters. Mr. Kintner's resignation took effect on March 31, and the partnership dates from April 1. He is highly indorsed, as the following letter from the Commissioner of Patents, with an indorsement from the Secretary of the Interior, will testify:

UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., March 17, 1887.

C. J. Kintner, Esq.

MY DEAR SIR: Your resignation has been received and transmitted to the Secretary of the Interior for approval. I need hardly say that I sincerely regret that you feel compelled to retire from the service of this office, and shall always gratefully remember your dilligence, faithfulness and very valuable services at the head of your most important division during my whole stay here.

I earnestly hope that you may meet with abundant success "out in the world" and be treated as well as you deserve to be.

Very truly yours,
M. V. MONTGOMERY,
Commissioner.

I concur in the within, and have often heard Commissioner Montgomery speak in the highest terms of Mr. Kintner as an officer conspicuous for his learning, intelligence and skill. L. Q. C. LAMAR,
Secretary.

So Be Grateful to Mr. Bell.

In Arkansas it costs 50 cents to call on a man on a public telephone. Even at that exorbitant rate it is said to be cheaper than calling him on a full hand.—*Yonkers Statesman.*

TELEGRAPHIC

.... Orange, N. J., hopes to have its electric railroad running in a few days.

.... The information published on another page shows how successful the Hess guest call was in saving lives at the Richmond Hotel fire in Buffalo, recently.

.... The little town of Fort Meyers, Fla., is supplied with the electric light free for three months each year, by Mr. Edison, covering the time he spends in Florida each winter.

..... The annual meeting of the Boston District Telegraph Company held at 5 Temple Court, N. Y., April 6, 1887, resulted in the election of the following gentlemen as directors: Wm. F. Chester, Francis W. Carpenter, Bailey W. Evans, Horatio A. Hunt, Clinton R. Weidin. The election of officers will be held in Boston.

... A company has been organized at Ansonia, Conn., for the construction of an electric railway three and one-half miles long, extending from the steamboat landing at Derby to Birmingham and Ansonia. Wire strung overhead will conduct the electric current, the motive power of which will be furnished by the Housatonic dam, one of the largest in New England.

.... Statistics recently published on the telegraphic communication throughout the empire of Austria show that during the past year a total of 6,351,363 telegrams were transmitted, of which number 1,920,000 were local messages in the Vienna district. The total receipts amounted to 3,564,119 florins, representing at the present rate of exchange, about £280,000. It is curious to note the large number of international messages as compared with those sent inland. Out of the total of over six millions, 1,347,374 were telegrams transmitted from or to places abroad.

....Not many years ago a Sheffield, Mass., scientific school youth, sent out to browse and take measurements, found a bridge down on some Housatonic connection of the Southern road which was not safe, according to his figuring. He submitted his "strain sheets" to the professor, and the latter, meeting Vice-President Reed on the street, mentioned the matter to him. "Send the boy to my office," said Mr. Reed, and thither the youth repaired with his sum worked out. He convinced Mr. Reed of the unsoundness of the bridge, and a new one was built. The old one has long been for sale for a highway bridge, and of course the boy is rapidly advancing in the engineering service of the Southern road.

.... It will, no doubt, be interesting to some to know that the somewhat despised instrument, the single-needle telegraph, has recently been turned to good account by being duplexed. Pressure of work upon the Glasgow-Carlisle circuit necessitated that some improvement should be devised in the working of a new wire erected to meet the anticipated summer traffic. Mr. A. S. Dunn, the superintendent of the Caledonian Railway telegraph system, has recently devised and applied a simple method of duplexing the single-needle instrument, and it is in work over a circuit nearly 110 miles long, with the best of results. This is accomplished by differentially winding single-needle coils; but it is found by later experiments that there is no necessity for going to the expense of doubly wound coils, seeing that the ordinary coils of the single needles, by being split at the brass connection at the back of the coils, will answer equally well. This is simplifying duplex working immensely, and will, no doubt, be largely taken advantage of by those of our railway readers who may see this.

Boiler Management.

VALUABLE HINTS FOR ENGINEERS IN THE FORM OF QUERIES AND ANSWERS.

(Prepared for the ELECTRICAL REVIEW.)

What about entirely closing the chimney damper ?

Ans.—It should never be entirely closed when there is fire upon the grate, lest explosions take place in the flues.

Before cleaning the fire, what should be done ?

Ans.—The damper should be opened to let the gases and dust pass into the flue.

What should be done about cleaning, if there is more than two furnaces ?

Ans.—They should be cleaned alternately.

How should a large furnace be cleaned ?

Ans.—Half at a time.

What is necessary before the fire is cleaned ?

Ans.—That there be an extra quantity of water in it, and a full head of steam.

Should cleaning be done with a full fire or with a low one ?

Ans.—With a full one, to prevent loss of fuel by lowering the temperature of the furnace.

Should you clean with a good fire or a poor one ?

Ans.—With a good one ; the furnace door having opened for a minute to take the white glare off it.

What should be done with the live fire in cleaning ?

Ans.—It should be pushed back to the bridge without disturbing any of the ashes or cinders.

When this is done what next ?

Ans.—The ashes and cinders in front should be removed, and then the proceeding reversed ; drawing the live fire front, and taking out the cinders at the back.

What next ?

Ans.—The fire evenly spread, and what ashes and cinders remain picked out, and a thin layer of fresh coal put on.

When is the time to clean ?

Ans.—Only when there is no white light shines through the grate into the ash pit.

Is it always necessary to clean when there is no white light shines through the grate to the ash pit ?

Ans.—No ; it is better sometimes, especially with anthracite, to clean from below with a thin hooked poker.

How about the necessity of cleaning a fire of bituminous coal ?

Ans.—It should be broken up often to let the air get through. It should then be pushed back towards the bridge, and a small amount added in front and allowed to coke.

Suppose the fire has been let get low or the grate uncovered, what should be done?

Ans.—There should be put upon the bare places some waste, wood, or other light combustible substance, then some coal thrown on and the damper opened out.

What should *not* be done in this case ?

Ans.—The thin part should not be poked, as that might put it out.

Should the glass water-gauge be relied upon exclusively to show the level of the water in the boiler ?

Ans.—No ; it may give false indications.

When two or more boilers are connected by feed pipes, what should be done about the stop valve upon each ?

Ans.—It should be shut off when not working, to prevent the water from escaping from one to the other.

What precaution with reference to the safety valve, in starting up ?

Ans.—It should be raised to see that it is in proper working order.

What should be done in case the water is dangerously low ?

Ans.—Throw open the fire doors to let cold air to the plates and draw the fire.

What is the first duty of an engineer in the mornings when he enters his boiler room ?

Ans.—To try all the gauge cocks to see that he has enough water, and just enough.

What precaution should be taken to prevent the pressure gauge from freezing ?

Ans.—The drip with which it should be furnished should be opened.

What may be the causes of low water ?

Ans.—Insufficient feed, foaming or leakage.

Suppose that you know that the water is too low, but do not know how low it is, what should be done ?

Ans.—The fire should be drawn, or else choked with ashes or earth ; then the furnace door left open, as well as the ash-pan door and the damper.

What should be done if the steam pressure gets too high ?

Ans.—If there is sudden increase of pressure, the damper should be closed and the feed put on, unless there is low water as well. If the pressure is dangerous, the furnace doors should be opened, and the ash-pan doors shut.

What about the condition of the ash-pan ?

Ans.—It should be kept clean to protect the grate bars and keep the draft free.

How can the amount of water in the boiler be properly told ?

Ans.—By the gauge cocks.

How can you see whether or not the glass water gauge shows the true level ?

Ans.—Shut off the lower gauge cock; drain the glass by the lower glass cock ; shut the glass cock and open the gauge cock; if the water does not rise to the same height as before, the water gauge is not in good condition.

Before starting the fire what should be seen ?

Ans.—That there is enough water in the boiler, and not too much; that the furnace (or fire box, as the case may be) and all the flues are clean; that the grate bars in their right places that (in case repairs or inspection have been made) there is nothing left in the furnace (or fire box) and the flues; that the upper gauge cock is open, or the safety valve partly lifted, to let the air out while the steam is forming; that the pump, dampers and doors are all in good condition; as well as all the fixtures and appliances.

What should be done in case the engine stops suddenly and lessens the demand upon the boiler ?

Ans.—The furnace door should be opened, the fire covered with fresh fuel and the damper turned.

What should not be done ?

Ans.—The safety valve should not be touched.

What is a furface blow off ?

Ans.—A pipe arranged so as to discharge the water at or near the water level; of use in discharging greasy or light solid matter which floats on the top of the water of the boiler.

Is there danger from raising the safety valve suddenly ? If so, what and why ?

Ans.—Yes; there is danger that the whole body of water in the boiler may suddenly lift up.

How about testing gauge cocks ?

Ans.—They should be frequently examined and blown off; being opened and closed gradually; and they should be ground on their seats when they leak.

What precaution should be taken about ashes ?

Ans.—They should not be allowed to accumulate about the water legs or other lower portions of the boiler, as they are corrosive when wet.

What is the danger of neglecting to keep the boiler clean ?

Ans.—Burning or blistering the portions which are covered with scale, and consequent increased liability to explosion under working conditions.

Dynamo Electric Machine of the Continental Hotel, Paris.

They have placed at the Continental Hotel, Paris, the most powerful electric machine of Gramme type which has yet ever been constructed.

This machine, of which the engraving on page 3 gives a very exact idea, had to fulfill especial conditions, imposed by the small amount of available room. Its maximum of speed was not to exceed 350 revolutions per minute, and at that rate it had to produce a current of 490 amperes with a tension of 100 volts. This problem has been entirely solved by the firm of Bréguet (which proves that it as easy to-day to calculate the dimensions of a dynamo machine, the power of which is indicated beforehand, as in those of a steam engine); it has, therefore, seemed interesting to publish the means which have been used for solving said problem.

The machine is bipolar, with horizontal electro magnets, the controlling pulley is very near the ring, and between the two supports, so as to reduce the amount of occupied space. The supports are supplied with automatic lubricators.

The total weight of the machine is 8,000 kilogrammes, not including the tightening carriages, which allow to tighten the controlling belt.

The dimensions of the supporting frame are 1 m. .95 in length and 1 m. .90 in width, and the total height above ground is 1 m. .60.

The exterior diameter of the armature is 0 m. .85, which gives at 350 revolutions a linear speed of 15 m. .25 per second. The armature is mounted upon its arbor by the means of two quadruple arm cross-pieces which insures a rigid motion and allows of internal ventilating. The weight of the copper wire which constitutes the electrical part of the armature is only 71 kilogrammes, and its resistance is $\frac{78}{10000}$ ohm. The resistance of the inducing circuits, which are excited as a shunt in respect to the principal circuit, is 6.20 ohms, and the weight of the coiled copper is 600 kilogrammes. The intensity of the exciting current, according to ohm law, is then 16.93 amperes.

The exciting of the magnetic field is regulated by a switch rheostat placed by the side of the machine; by introducing in the exciting circuit a variable resistance it is easy, according to the charge of the machine, to graduate the intensity of said circuit.

It is easy to ascertain, by the means of the figures which we have just given, the electrical efficiency of the machine; after the calculating it is found to be 0.93. The total electric power of the machine in full charge is 60 horses, and the useful available power is 55.8 horses

This powerful machine feeds the Edison's incandescent lamps, which light the hotel

Dimensions of Lead Safety Fuses.

From the results of a great number of experiments, a series of curves were plotted connecting the diameter of the lead wires with the current they could carry. The experimental curves thus obtained do not differ materially from that derived from calculation.

Let R be the resistance of the lead wire,
I the current,
$2r$ the diameter of the wire,
l the length of the wire,
V the temperature at which lead melts (335° C.),
t the temperature of the surrounding air,
a the specific resistance of lead (20 microhm. cm.),
a a coefficient of cooling,

then, on the supposition that the electric energy furnished by the current is equal to the heat radiated, we have

$$R I^2 = a (V - t) 2 \pi r l ;$$

but

$$\frac{a l}{\pi r^2} I^2 = a (V - t) 2 \pi r l,$$

therefore

$$I = \sqrt{\frac{2 a (V - t) \pi^2 r^3}{a}} ;$$

and if we put

$$K = \pi \sqrt{\frac{2 a (V - t}{a}},$$

$$I = K \sqrt{r^3}.$$

K may be determined experimentally ; for 1 mm. diameter of wire and 11 amperes it is 100. It will be noted that the length of the lead wire does not appear in the final equation.

PERSONAL NOTES.

Lieut. F. W. Toppan, U. S. N., has been on sick leave for two years past, and it is doubtful if his health will ever permit active service. In electrical circles he has a number of warm friends, and at present makes his headquarters in New York.

Norman McCarty, the active representative of the Little-McDonald cut-out—an electrical appliance that was introduced to the electric lighting fraternity about nine months ago—has had the satisfaction of placing over 5,000 of these among electric companies.

A delegation from the seat of culture swooped down on guileless and unprotected New York last week, and for two days all the new electrical work here was investigated. Among these electrically-inclined Bostonians were Messrs. A. V. Garratt, Fred. Swift, M. M. M. Slattery, and P. Fahey.

Mr. A. F. Stanley, formerly with the Western Electric Company, is rapidly building up a fine electrical business in the firm of Hazazer & Stanley. His former friends in the West, where he was a tourist at one time, will be pleased to learn that his work in this city is bringing such excellent and well-merited returns.

Marshall P. Wilder, who will be present at the celebration of the first anniversary of the Electric Club, is probably the most popular entertainer on the two continents. His work is always new and exceedingly cheerful. The telephone story he tells will appeal directly to a number of his auditors on the night of the annual meeting.

Probably the youngest member of the Executive Committee of the National Electric Light Association is Mr. Stephen Holbrooke, of Philadelphia, who is largely interested in a number of local light furnishing companies. He is progressive and broad-gauged, and will do good work as counselor in the National Association.

Mr. I. H. Farnham, electrician of the New England Telephone and Telegraph Company, is the inventor of a number of successful electrical appliances, and last week received his sixth patent, covering a protector against strong currents. This appliance is in use on 1,000 telephone sets, and is giving entire satisfaction. One peculiar advantage claimed for it is that it will cause no trouble from lightning discharges.

The Electrical Accumulator Company, of his city, has around it a staff of active and intelligent workers. One of the younger members is Mr. T. P. Conant, son of the late editor of *Harper's Weekly*, who has made electricity his study and work for a number of years, and is now in position to make excellent use of his knowledge and experience. He has recently received patents for electrical devices to be used in connection with storage batteries.

Among recent Western visitors to New York was Mr. J. W. Phillips, of Kansas City, Mo., vice-president of the Kansas City Electric Light Company. There is no better managed electric light company in the country than this one, with Mr. Phillips as an active financial and commercial official, and Mr. E. R. Weeks at the head of the electrical and practical department. A new additional station is to be constructed at once, from which electric light and power will be furnished. The Sawyer-Man incandescent light, in use in the present station, gives fine satisfaction, and in the new station the Edison system will be placed. These two systems of incandescent lighting will, therefore, both be on their good behavior, and will both be installed in a model manner. The efforts of Messrs. Weeks and Phillips in convincing their stockholders of the great future in electric lighting and electric power have evidently proved effective.

An Advantageous Deal by the American Electric Manufacturing Company.

This company has purchased the entire property and assets, including all patents of the Fuller Electrical and Fuller-Wood companies. This places the American Company in a much stronger position and saves the payment of royalties, which would have amounted, it is estimated, to nearly $2,000,000 during the life of the patents. The entire system is now owned and controlled by the American Company, papers having been recently signed by President Goff and President Appleton, of the respective companies.

ELECTRICAL NOTES FROM FITCHBURG, MASS.

(From a special correspondent of the ELECTRICAL REVIEW).

The Fitchburg Steam Engine Company are busy filling orders for the various styles of automatic engines they build. Their engines, while possessing moderately high piston speed, are capable of performing continuous duty at an economy unsurpassed by the slowest speed engines. To meet a demand for a first-class high speed engine the company have prepared to furnish such, and have already supplied Pratt & Cady, throttle valve manufacturers, Hartford, Conn., and Houghton & Dutton, Boston, Mass., where it will be used to drive an arc light plant of the Van Choate Electric Company. The engine has 10 by 12 inch cylinders, and is run at 300 revolutions per minute and is rated at 50 horse power.

The Wachusett Electric Light Company are running incandescent lamps about 2,000 feet from their station, using a Mather dynamo, and have some incandescent lamps on arc circuits. The arc plant consists of four 25 arc and three 10 arc lights, nine 6 ampere Thomson-Houston dynamos. 85 to 90 arcs are at present in use, of which 44 are used for street lighting; the number for which purpose is to be increased, as petitions have been presented for more light, and lack of funds alone stands in the way of an increase. The superintendent is A. H. Kimball; engineer, Matthew Mannix; dynamo man, H. L. Battle; Linemen, F. Morgan, T. F. Mack, J. P. Hurley. A Fitchburg 150 horse power double engine is used, one side of which is disconnected during the summer season. Steam is supplied by one Dillon and one Robinson boiler, both set with Jarvis furnace. The boilers are each 100 horse power, and connected to a 65 foot stack. The fuel employed is 3 parts screening to 1 part of Cumberland coal. It is rumored that the gas company are to soon install an electric light plant, both arc and incandescent, on secondary generators. A. M. PERE.

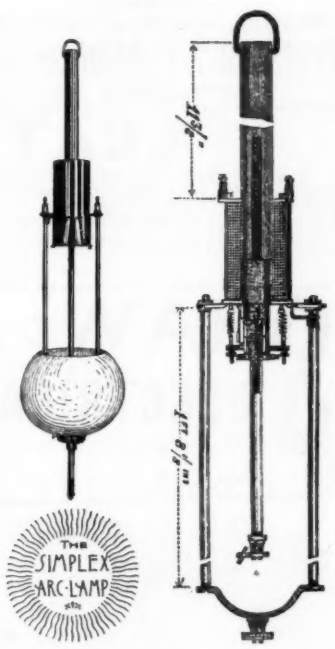
Fitchburg, Mass., April 7.

Passenger Lift for the Eiffel Tower.

The enormous height of this tower renders a hydraulic lift, in which passengers could perform the whole journey in one operation, quite impossible; and a succession of shorter lifts, requiring frequent changes, would naturally be considered too cumbersome by the public who will use the tower. On the other hand, the employment of a winding engine and a lift similar to those used in mines, would not be sufficiently safe, and for these reasons M. Eiffel has devised a new type of lift, in which the whole ascent can be made in one journey, whilst at the same time it presents absolute safety. The main idea of the lift is that of a huge screw and nut. Below the lift cage is placed a trolley, with three or more wheels running upon an equal number of rails, which ascend spirally, and thus form a screw having so many threads. The trolley will be revolved either by an electric motor or by a water engine; but the cage will be prevented from revolving by guide bars. Thus the passengers will not feel anything of the rotary motion of the trolley underneath, and by selecting the pitch of the screw sufficiently small, any degree of safety against a too rapid descent can be obtained.—*London Industries.*

Description of Simplex Lamp.

It is an easy matter to build an arc lamp of complicated mechanism, but one simple and reliable requires the highest mechanical and electrical skill to construct. The Simplex lamp consists of a solenoid with series winding, containing a core of soft iron, in the center of which is supported a rack to which is attached a ratchet wheel pendulum and escapement. When the current is turned on the core is lifted and the top of the pendulum engages in a detent, thereby preventing feeding. The length of the arc is made by the distance the solenoid moves before striking the detent As the arc becomes long the resistance increases, the attraction of the solenoid becomes less, the core drops, releasing the pendulum from the detent. The pendulum makes two or three oscillations and the upper carbon descends one or two one-hundredths of an inch. By means of a spring pulling the core upward, the period of feed is changed There is also an arrangement for adjusting the length of the arc. The weight of core and rack is so



THE SIMPLEX ARC LAMP FOR USE ON INCANDESCENT CIRCUITS.

many times heavier than the weight of the carbon, that the difference in weight by the consumption of the carbon makes no appreciable difference in the length of the arc. The series lamp has in addition a high resistance shunt coil, automatic cut-out and relighting coil. Double lamps of this pattern are used with great success in the Great Eastern Railway station, London. For incandescent circuits the lamp works to the best advantage, with a current of 60 volts and 9 to 10 amperes, for arc light circuits a current of 10 amperes and 46 volts is employed.

This lamp is owned by the Simplex Company, of Boston, the Electric Construction and Supply Company, of 145 Broadway, N. Y., controlling it for the Middle States.

—— The Edison Illuminating Company, of Detroit, was organized on the 15th day of April with a capital of $250,000. The enlistment of this large amount of money in a comparatively new enterprise in a very short period of time was the work of J. R. McLaughlin, the present manager, under whose direction the station building on the corner of State street and Washington avenue was built and equipped with all the necessary machinery, seven miles of underground street system laid, and inside wiring done for 5,000 lamps. The ultimate capacity of the station will be 20,000 sixteen candle power lamps, of which 5,000 are now installed Many of the principal stores on the leading avenues of the city are using the light, which gives perfect satisfaction. White's theater, which is lighted with this light, is splendidly lighted Early in the spring the company intend extending their system so as to embrace the residence portions of the city.

Storage Battery Suits.

The Brush Electric Light Company commenced suit last Friday in the United States Circuit Court of New York against the Electrical Accumulator Company and the Julien Electrical Company for infringement of their patent. Some one, it would seem, owns the patents on the storage battery, and who he is the courts will have to decide.

Efficiency of a Zipernowski Deri Transformer.

According to the data of the makers, Ganz & Co., the transformer experimented upon was intended to work with 1,400 watts, with a primary current of 300 volts, and had a coefficient of conversion of 1-5. The most suitable number of alternations was 100 per second; the resistance of the primary coil was 0.943 ohm, and of the secondary 0.107 ohm. The current was measured both by a Siemens electro-dynamometer and by a calorimeter, the results as given by the two instruments agreeing very closely; and the difference of potential by a Cardew voltmeter. The various parts of the apparatus were connected together by means of wires and suitable mercury cup commutators, so arranged that the several measuring instruments could be inserted in either the primary or the secondary circuit.

The results are given in the following table:

Primary Current.	Primary E.M.F.	Secondary Current.	Secondary E.M.F.	Work put in.	Work taken out.	Efficiency per cent.	Alternations per second.
2.71	125.5	12.42	24.0	340.105	293.080	87.6	102
3.00	142.5	14.36	26.4	427.500	379.104	88.6	102
4.37	191.3	20.91	35.6	835.606	743.668	88.9	100
4.83	208.0	23.47	39.5	1008.987	927.003	91.8	100

—— The Electric Gas Lighting Company, of Boston, has issued a handsome and well illustrated catalogue, of about 70 pages, in which particular mention is made of their very excellent line of electric gas lighting apparatus. In this department the company has made some valuable improvements as well as in a number of new specialties, several of which were recently described in this journal. Their electric gas lighting apparatus is very popular in New England. The new catalogue is mailed free to all requests for it, sent to 35 Arch street, Boston.

—— The Columbus, Ohio, Electric Light and Power Company has been compelled to increase its plant; the present capacity of 350 lamps not being sufficient for the demand. Since this company has been in operation they have made a splendid record. During the three years they have been furnishing their light, they never failed but two nights in all that time in keeping their circuits unbroken and their lights burning. The two nights which broke this splendid record were but recently, during the prevalence of the great wind storm, which broke the wires and destroyed the use of one circuit. and shutting out but 26 lamps. The manager of this company, Mr. J. G. McGuire, is a practical man in every respect, and thoroughly understands the business, which, under his care has grown to such gratifying proportions. The president is E. T. Mithoff, and vice-president, Wm. Monypeny. The station is located at the west end of Broad street bridge.

ELECTRIC LIGHT NEWS

—— The Gadsden (Ala.) Electric Light Company has organized, with A. Herzberg as president; W. B. Myers, secretary, and W. P. Lay, treasurer.

—— A year's contract has been made by the city of Millville, N. J., with President Holbrooke, of the electric lighting company there, to light the city for one year. The Schuyler system is used.

—— Taxpayers and residents of New York on the upper west side are preparing a petition to present to the Mayor and Common Council, asking that Eighth avenue above 125th street be lighted with electric lights. As the Mayor is in favor of such improvement, it is likely that the petitioners will be gratified.

—— Messrs. C. V. Walker & Co., real estate agents, of Augusta, Ga., have sold to the Thomson-Houston Electric Company, of Boston, a portion of the Harker tract of land. This company will immediately erect electric light works on the site, to be run by water power, and will supply most of the large factories along the canal, besides many houses in the city.

—— The Utica Gas Light Company and Central New York Electric Light and Power Company were consolidated under the name of the Utica Electric and Gas Company, with $300,000 capital. The officers of the new company: Wm. J. Bacon, president; E. A. Graham, vice-president; W. P. Fish, treasurer and general manager; Thos. N. Mooney, secretary; Jno. W. Bates, engineer.

—— Electric lighting is making rapid strides in Germany. Already several large town installations exist, and their number is being added to at short intervals. It is now announced that a number of the principal inhabitants of Gelsenkirchen have formed themselves into a company, with a capital of £12,500, to light that town by electricity. Herr Weuste, of Mulheim, has obtained the contract for the work.

—— The Watertown (N. Y.) Electric Light Company has increased from two dynamos, with 32 arc lights each, to six dynamos, with from 30 to 32 arc lights each, or from 64 arcs to 190. The circuits are now separated so that the city lights are on distinct circuits, no private lights being placed on them. The city lights are divided into three circuits, 25 lights being on one circuit or one dynamo, 30 on one, and 30 on another —85 in all.

—— As is usually the case, the electric light was at first blamed for causing the Richmond Hotel fire. Geo. Watrous testifies as follows: "I am in the employ of the United States Electric Light Company. I run the machine at the Brush station on Wilkison street. On the morning of the fire I cut off the light from the Richmond at 1 o'clock. I was on until 1 o'clock, when we shut down. It was turned on again at 7 in the morning." Several witnesses testified corroborating this evidence.

—— The Gas-motoren-fabrik Deutz, of Deutz, Germany, who own the "Otto" patents in Germany, and attracted of late attention by the large sizes of Otto engines furnished to city water works and electric light stations, have just obtained a decision in their favor in their suit against Moritz Hille, of Dresden, a manufacturer, and several of his clients and users of infringing engines. The decision establishes the infringement by the defendants, and orders them to discontinue the manufacture and use of the machines; also to account for damages. The Hille engine used the well-known Otto four-stroke cycle, and it is against its use that also other suits still pending against Körting Bros. and Buss, Sombart & Co. are directed. In these cases a decision may soon be expected.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 5, 1887.

360,429 Electro-cautery instrument for use in surgery; David H. Goodwillie, New York, N. Y.
360,447 Electric annunciator; John C. Kunkle, Hoboken, N. J.
360,448 Electric annunciator; John C. Kunkle, Hoboken, N. J.
360,492 System of electrical distribution; Francois Von Rysselberghe, Shaerbeek, Belgium.
360,517 Apparatus for recutting files; James E. Emley, Weatherford, Texas, assignor to W. J. Carson and T. D. Lewis, both of same place.
360,528 Quadruplex telegraphy; Francis W. Jones, New York, N. Y.
360,532 Connection for carbon elements in galvanic batteries; William P. Kookogey, New York, N. Y.
360,538 Electric lighting system; Jos. A. Powers, Lansingburgh, N. Y.
360,567 Insulating and protecting electric cables; Thomas H. Dunham, Boston, Mass.
360,570 Electric instrument protector; Isaiah H. Farnham, Malden, assignor to the New England Telephone and Telegraph Company, Boston, Mass.
360,626 Telephone receiver; Jos. H. Tabony, New Orleans, La.
360,638 Railway electric signaling apparatus; Geo. Westinghouse, Jr., Pittsburgh, Pa.
360,647 Target trap; John B. Bennett and Frank W. Samuels, Indianapolis, Ind.
360,655 Underground railway and pipe subway; Benj. F. Carpenter, Roselle, N. J.
360,660 Electric house bell; Edward G. Coleman, St. John's, Newfoundland.
360,662 Electric arc lamp; Charles F. Cooke, Buckingham Works, county of York, England.
360,672 Connection hanger for electrotyping apparatus; Otto S. Fertig, New York, N. Y.
360,696 Electric gas burner; Charles W. Holtzer, Brookline, Mass.
360,823 Electric thermostat or fire alarm; and 360,824, Automatic fire alarm system; William F. Singer, Carthage, assignor of one-half to Henry C. Anthony, Watertown, N. Y.

BUSINESS NOTICE.

CLEVELAND, O., March 30th, 1887.

On and after April 1st, 1887, the following prices will be charged for Brush copper-coated Carbons:

7-16ths inch	$25.00 per 1,000
½ inch	31 25 "
⅝ths inch	43 75 "

less ..... per cent. discount.

We propose to make but one grade of carbons, and shall endeavor to make the quality as nearly perfect as possible.

This increase in our prices of carbons is small, and the principal change, so far as our customers are concerned, is in the confining of our output to one grade.

A large part of our customers have been led recently to use our former grade of "seconds" carbons, largely or wholly in their lamps, on account of their low price, and this has resulted in very many cases in a lowering of the quality of the light furnished, and led to frequent interruptions in the use of ours. With our above quoted carbons and the requisite care in other parts of the service, the Brush Light should be superior to all others in all the qualities demanded by the business of electric lighting.

We are informed that the other carbon factories in the country have come to an agreement among themselves and have stopped the war in prices, which has been waged with such fury and loss.

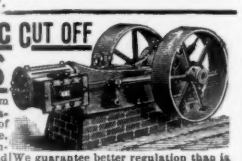
In order to enable you to adjust your orders for carbons to the new basis, we shall continue to fill your standing orders, already on our books, with the carbons ordered and at the old prices, until April 15th, but we will fill all new orders received after April 1st at the new prices.

THE BRUSH ELECTRIC COMPANY.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St.), New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend."
—*New York Observer*.

AUTOMATIC CUT OFF ENGINES



Embodying a new system of **Absolute Regulation** against a change of load and boiler pressure. The most perfect governing ever obtained. Send for circular F.

We guarantee better regulation than is possible for any other engine to give.

BALL ENGINE CO., ERIE, PA.

Wellington Belt Holder

The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to

W. R. Santley & Co.
WELLINGTON, O.

BUSINESS ANNOUNCEMENT.

We beg to announce that we have opened a supply house at 38 and 40 La Salle Street, Chicago, where we shall keep constantly on hand a full line of Electrical Supplies of every description, and with low prices, courteous treatment, and prompt attention to orders, we hope to merit your patronage, and respectfully solicit the same.

Very respectfully,
CENTRAL ELECTRIC CO.

BUSINESS NOTICE.

INCANDESCENT LAMP FOR SALE.—All the process for making 125 to 128 volt Incandescent Lamp, using half an ampere of current (or less); life tested full 600 hours average, and will stand shipping as well as a 50 volt lamp. Party will make them in connection with some good company, or sell the whole process for 50 volts to 150 volts. The lamp has a high efficiency—not at expense of life: 20 to 25 per cent. higher candle power per horse power than any 120 to 130 volt lamp in market; high volt.

Address "C. P." P. O. Box 3329, N. Y.

J. J. DICKEY, Pres. L. H. KORTY, Treas.

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Electrical Apparatus and Supplies,
HOTEL & HOUSE ANNUNCIATORS,
Fire & Burglar Alarms, Electric Gas Lighters, Electric Light Supplies.
Correspondence. Mail orders given special attention

CENTRAL ELECTRIC CO.
38 AND 40 LA SALLE ST., CHICAGO.

ELECTRIC LIGHT SUPPLIES,
Incandescent Cordage, Telephone and Telegraph Supplies, Insulated Wire, Bells, Push Buttons, Batteries, etc.

CORRESPONDENCE SOLICITED.

WE GLADLY TESTIFY to the SUPERIORITY of the
MUNSON
Eagle and Dynamo Electric Light Belt.

The stretch, otherwise than the elasticity, is removed, no rivets and perfect evenness in heft, the result noiseless with a perfect motion, which is absolutely essential for a steady light. We use no other make. The character and responsibility of the house is unquestioned.

TESTIMONIALS.

Western Edison Light Co., H. WARD LEONARD, General Sup't.
W. J. Buckley, Mgr. Ft. Wayne Jenny El. Light Co.
Thomson-Houston Electric Light, Herbert Wadsworth, Manager Western Office
Brush Electric Co., Alex. Kempt, Special Agent
Excelsior Electric Co., C. J. Reilly, Western Mgr.
Sperry Electric Light Motor & Car Brake Co., 201 Royal Insurance Building
J. H. Reid, General Manager of the Mather Electric Light Co., Chicago.
Wm. H. Purdey, Comm. of Public Works, Chicago.
John Mab, Chief Engin'r of Board of Trade, Chic.
C. J. Melmes, Gen'l Sup't Thomson-Houston Light, Omaha, Neb.
J. A. Corbey, St. Joe Electric Light and Power Co., St. Joe, Mo.
Wm. Oswald, Agt. Edison Light Co., New Orleans, La.

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240 & 242 RANDOLPH ST., CHICAGO.

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EXPERTS IN ELECTRICAL CASES.
John A. Wiedersheim, late J. A. Wiedersheim & Co.
Charles J. Kintner, late Principal Examiner Class of Electricity U. S. Patent Office.
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MANUFACTURERS OF
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INCLUDING
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INSULATED MAGNET, TELEPHONE AND ELECTRIC LIGHT WIRE.
GENERAL OFFICES and FACTORY:
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CARBONS
FOR ARC LIGHTING.
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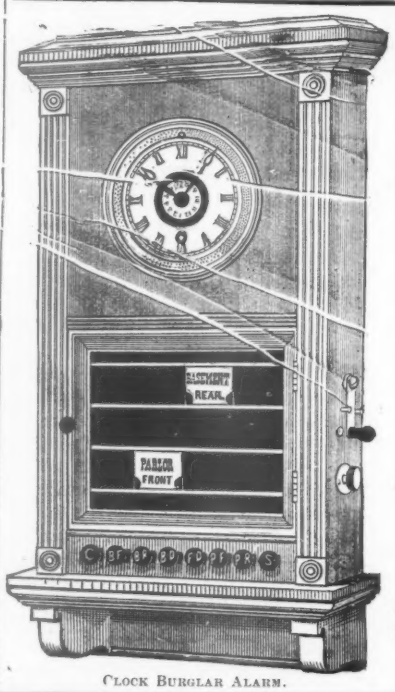

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